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Packing-House Industries

27 Illustrations

Prepared for the International Correspondence Schools by

L. M. TOLMAN

CHIEF CHEMIST, WILSON & CO.

PACKING-HOUSE INDUSTRIES
MEAT-INSPECTION REGULATIONS

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PREFACE

The volumes of the International Library of Technology are made up of Instruction Papers, or Sections, comprising the various courses of instruction for students of the International Correspondence Schools. The original manuscripts are prepared by persons thoroughly qualified both technically and by experience to write with authority, and in many cases they are regularly employed elsewhere in practical work as experts. The manuscripts are then carefully edited to make them suitable for correspondence instruction. The Instruction Papers are written clearly and in the simplest language possible, so as to make them readily understood by all students. Necessary technical expressions are clearly explained when introduced.

The great majority of our students wish to prepare themselves for advancement in their vocations or to qualify for more congenial occupations. Usually they are employed and able to devote only a few hours a day to study. Therefore every effort must be made to give them practical and accurate information in clear and concise form and to make this information include all of the essentials but none of the nonessentials. To make the text clear, illustrations are used freely. These illustrations are especially made by our own Illustrating Department in order to adapt them fully to the requirements of the text.

In the table of contents that immediately follows are given the titles of the Sections included in this volume, and under each title are listed the main topics discussed. At the end of the volume will be found a complete index, so that any subject treated can be quickly found.

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PACKING-HOUSE INDUSTRIES

(PART 1)

INTRODUCTION

1. Historical.—The packing industry is said to have been carried on in the New England States as early as 1640, but not in the same way in which the modern business is conducted. The oldest record of such an establishment perpetuated to this day, is claimed by a Philadelphia firm which started packing in the primitive way of the times in 1760 and developed its methods into those of the modern packing house.

The packing industry with its diversified components as now understood dates from the year 1818 when an establishment was started in the city of Cincinnati, which soon became the center of this industry. One reason for this was the surrounding corn-raising area—the natural territory for a steady supply of hogs. As the population and facilities for shipping increased, the corn-belt area moved farther west, followed by the packing houses locating near their supply of raw material. Chicago, being situated in the corn-raising area and having natural transportation facilities because of its location at the head of Lake Michigan, followed Cincinnati as the center of the packing industry and is now indisputably and universally acknowledged as the center of the meat industries of the world. Thousands of cars of cattle and hogs, both live and dressed, are shipped from Chicago annually in addition to those animals slaughtered for consumption in the immediate vicinity.

Within the last few years large and important interests have developed in the packing industry farther west, notably

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in St. Louis, Omaha, St. Joseph, and Kansas City, for the obvious reason of the close proximity of supplies of cattle and hogs raised in the sparsely settled Western States. Although these cities are large packing centers, Chicago, mainly on account of its prestige and almost unequaled water and rail shipping facilities, still maintains its supremacy.

Still more recently the packing industry has spread farther to the southwest, even into Texas, because of the modern tendencies in business to establish the manufactory at the base of supply of the raw material—in this industry, the live animals for slaughter.

2. The primitive methods of this business have practically been revolutionized. In former times, natural temperatures and ice were the only available means for preserving the manufactured products, in consequence of which the packing was carried on in the winter months only. Artificial refrigeration and the power to control temperatures, however, have made it possible for this industry to be carried on throughout the year. In addition to this, it is now possible to consume in the great consuming centers the meat of animals which are slaughtered thousands of miles away. It is transported in scientifically built refrigerator cars, a thing unknown until a few years ago.

In addition to artificial refrigeration, another influential factor in developing the modern, scientific packing industry, is applied chemistry. If it were not for the ingenuity of the chemist, who finds a way to utilize the offal of slaughtered animals, the price of meat would be much higher. The chemist has turned into practical channels of income what was formerly not only waste but a source of expense for its removal.

The object of the primitive packing industry was simply to produce meat. The object of the present scientific packing industry is not only to produce meat but also to utilize every available part of the animal. This objective is now attained to the highest degree in the large modern packing houses.

3. Breadth of the Packing Industry.—The packing industry is so very broad that at present it covers an enormous field. Not only does the modern packing house pack pork and beef in the same manner as when this industry was started on a large scale, but it also produces and handles many foods other than those produced from livestock.

The modern packing establishment may be termed, in common language, a food factory. Animal and vegetable foods and compounds of the two are produced in many forms; in addition other edible compounds which verge closely on the pharmaceutical field are also produced. This is evidenced by the production of beef extract, which, as prepared in the packing house, may hardly be considered a food but rather a stimulant.

A step farther than this are the preparations known as digestive ferments, not food, but still alimentary products. Still further bordering on the pharmaceutical field are the preparations frequently produced (in the largest establishments), such as inspissated ox gall and the so-called animal extracts, as pituitary extract, adrenaline, thyroid extract, and other gland and tissue extracts.

4. There are so many offshoots in the modern packing industry that it is difficult, in fact, to draw a line where this industry ends. So many by-products of the animals slaughtered are now made into finished products by the packers that the tendency is to handle in one establishment the entire product and by-product of the slaughtered animals.

When the slaughtering business first became established on a large scale there grew up in the vicinity of the packing plants independent establishments the purpose of which was the handling of the by-products collected from the packing houses. Glue works, fertilizer works, soap factories, oil and tallow works, and the like were in a large measure separate from the slaughtering concerns. As the packing business developed on modern and scientific lines and became concentrated in the hands of the larger companies, the allied industries were gradually—but, finally, almost completely—taken over by them. Various important economies were thus effected by unification and are being further effected from time to time.

At the present time, the leading and largest packers carry the elaboration of almost every possible by-product to an advanced stage. Frequently, the elaboration is carried out to the finished article of the product or by-product, so that it goes directly from the packer to the consumer, as evinced by the manufacture of such things as sandpaper, glue, sizing, hair felt, curled hair, anhydrous ammonia, finished fertilizer, soap, pepsin, etc. No matter how the various packing houses may differ in the degree to which finished products are made from their material, they are all actuated by one principle—they do not permit anything of value to be wasted.

5. The meat-canning industry is closely associated and nearly always contiguous to the packing house both for convenience and for profit. This industry is complete in itself, although it is practically inseparable from the packing-house proper. The canning industry will therefore be described, as the economical management of the modern packing house depends to a very large extent on this resourceful branch of the business.

The most important feature in the utilization of by-products in the packing house is observed in the fertilizer department, as here all animal products which are not useful for food or manufacturing purposes are converted into a remunerative article—fertilizer—either finished, that is, complete fertilizer, or the crude form, known as tankage. This subject will be treated in its proper place. The establishing of this department may be said to mark the transition of the simple slaughter house of former days to the modern packing house in all its phases. Formerly, dressed meat only was produced, and the offal was a source of expense and encumbrance to the packer who willingly paid for having it taken away. With the knowledge acquired from the utilization of one by-product, as a natural consequence the utilization of all followed.

The establishment of the glue department by the packing houses as a necessary adjunct is among the comparatively recent innovations as well as one of the most important. This subject will be treated at length under its proper caption, as will also various other industries that are closely associated with it

6. The development of the packing industry as it now exists is due in great measure to the knowledge and research of the packing-house chemist. Not only has the chemist aided this development, but he is engaged in furthering still more the utilization of the various waste products. In addition to this, the modern packer depends on chemistry to aid him in conducting the whole industry on an economical and profitable basis.

This will be readily apparent when the many operations are described in which chemistry plays such an important part in determining the grade or class and, consequently, the price of the finished product. The chemist of the packing house is daily called on to perform tests and analyses by which each day's output is controlled. For example, the amount of tallow or grease remaining in the cooked offal is such an important item that a daily report on the percentage left in this material is given to the superintendent. This one feature alone may be the cause of profit or an immense loss to the establishment. This shows the importance of applied chemistry in this industry.

The field for the chemist in the development of by-products is most inviting and offers unlimited opportunity for the research and development of industrial and other uses for the offal.

7. Method of Conducting Establishments.—The modern, large packing house in every department is conducted on strictly business principles. The different departments are regarded as independent concerns, the raw material received by each department being considered as purchased from an independent source, and the cost price charged up to its account. At the same time the department furnishing the material is credited with the price charged. The finished product turned out by each separate department when sold has the amount received credited to that department. All supplies, labor, utensils, etc. constitute a direct charge to the department receiving them; and, in addition, to each is apportioned pro rata, insurance, taxes, cartage, steam, light, office, selling expenses, etc. In this way it is ascertained what each department is contributing to the general profit or loss. Each day a report of its receipts, shipments, labor, etc. is given to the general manager, who in the summary is thus enabled at a glance to see the status and condition of the whole establishment. The labor cost is closely scrutinized and should it be found that this is in excess of the regulation established, an investigation immediately results and an explanation is obtained. From years of experience and by frequent tests made in all departments of the establishment, the exact cost of each product and by-product is accurately known and regulated.

Constant investigations with a view to perfecting methods and curtailing wastes, are being made, and new avenues are found for the further profitable working and disposition of by-products.

8. In no business is more attention given to detail and there probably is no business where the average profit on each individual product is so small that the slightest inattention to detail results in serious losses. There have been periods in the packing industry when operations have been carried on in almost every department at a positive loss; but as so much machinery and apparatus are required in this industry, the small loss incurred from operating was far less than would have resulted from idle machinery, rusty tanks, etc. It may be truthfully said that of all departments of this industry there is only one from which a good profit is always expected and generally obtained, namely, the sausage department. This branch of the industry has the advantage of being able to utilize parts from all slaughtered animals passing the necessary inspection, while the other departments manufacturing the goods are restricted to a particular class of material.

The general methods of treating and caring for packing-house products and by-products will be presented as they are daily carried out in the modern packing houses in the United States. If it were not for the utilization of by-products dressed beef would have to be sold at a much higher price. Broadly speaking, the value of beef from the average steer is about three-fourths of the total value of the products obtained from the animal.

MEAT INSPECTION

9. In 1906 owing to various loose and negligent methods and practices in many packing houses, a most rigid government inspection law covering the whole packing and slaughtering industry was passed by Congress and went into effect on October 1 of that year. This law was enacted for the purpose of preventing in interstate or foreign commerce the use of meat and meat-food products that are unsound, unhealthful, unwholesome, or otherwise unfit for human food, under the authority conferred on the Secretary of Agriculture by the provisions of the act of Congress approved June 30, 1906.

Regulations are prescribed for the inspection, reinspection, examination, supervision, disposition, and method and manner of handling of live cattle, sheep, swine, and goats, and the carcasses and meat-food products of cattle, sheep, swine, and goats, and for the sanitation of the establishments at which inspection is maintained. These regulations supersede those of 1897 and those of 1904, excepting portions of the latter law and amendments that relate to the microscopic inspection of pork.

As the law of 1906 made necessary extreme and radical changes in many of the products, their nomenclature, and methods of preparation, and as this law has such a direct bearing on the whole industry, the regulations governing the meat inspection of the United States Department of Agriculture are given in an accompanying pamphlet.

A national pure-food law was also enacted in 1906. This law likewise has a direct bearing on many of the products emanating from the packing house, especially as relating to the names under which the prepared food products are sold.

The new meat-inspection law and the national pure-food law, the latter known at the Food and Drugs Act, are correlated in many respects as applied to food products made in the packing house; hence the rulings and interpretations of the law as applied to these products are also given.

While the use of preservatives in food products for domestic consumption is prohibited, the law permits the use under certain restrictions of preservatives in meat and meat-food products for export, but does not permit the use of any dye or coloring matter not permitted in meats prepared for interstate trade.

VARIOUS ANIMAL PRODUCTS AND THEIR DISPOSITION

BEEF PRODUCTS

10. The disposition of a bullock in the modern packing house is quite complex. To obtain the best financial results, the operations of caring for the various by-products are carried out in great detail. By referring to the chart, Fig. 1, it will be seen into what products a bullock is ordinarily resolved. It is important for a chemist dealing with animal products to know the source and nature of material with which he has to deal. Further than this, knowing the characteristics of certain products, he can very often, by a superficial examination of material in question, at once name the source of its derivation.

This is especially true of tallow and lard. Certain parts of animal fats have, as is well known, different melting points. For example, the tallow obtained from a bullock's head will have a titer, or hardness, not exceeding 41.5° or 42° C., while the tallow from the small intestines will have one of about 44° C. When an ordinary tallow is found with a hardness of over 44° C., the origin is at once placed to the fat of the kidneys.

11. The resolution of the bullock will be treated first, that of the hog afterward. While the chart, Fig. 1, shows the detail in a general way, some of the by-products are subdivided still further. The method of handling in the particular packing house determines this. For example, as shown in the chart, the feet, among other things, yield sinews, neatsfoot oil, and raw bone. Taking these products, it is possible by further treatment of sinews to obtain glue, neatsfoot oil,

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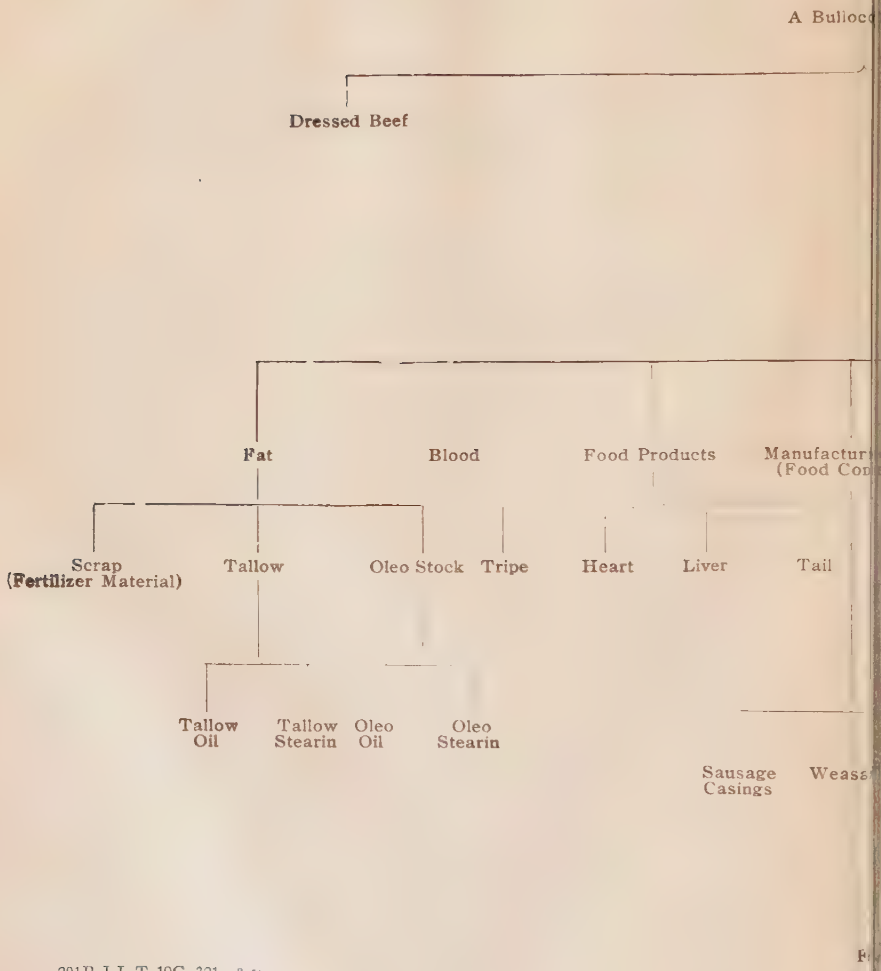

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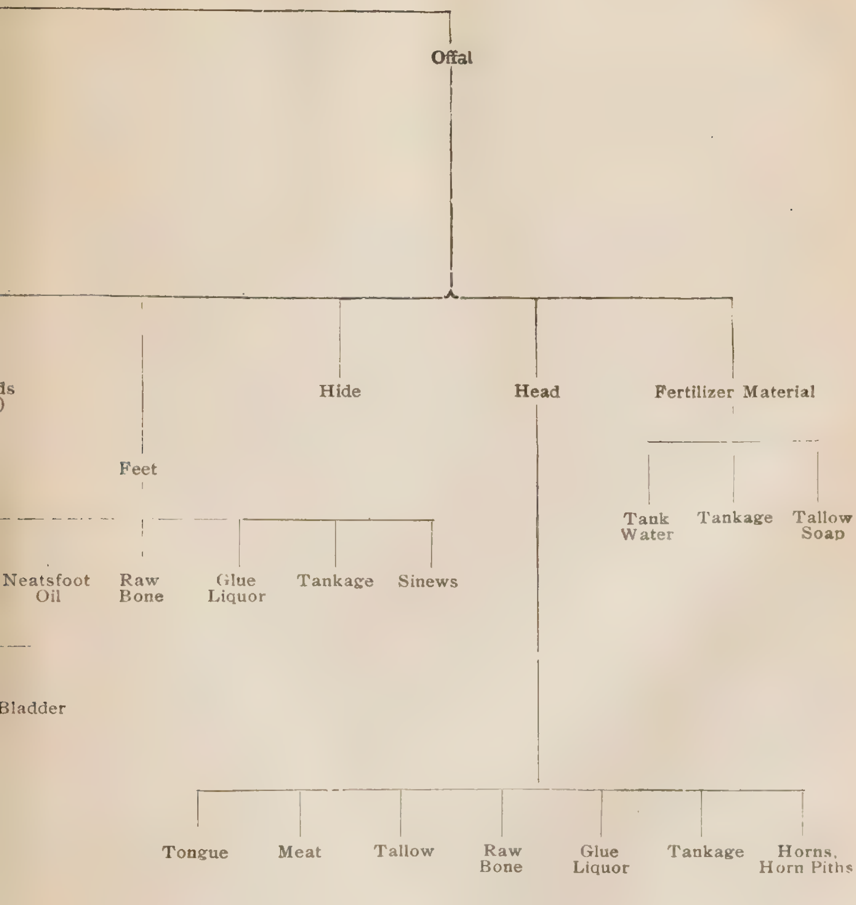


and tankage. From the neatsfoot oil cold-pressed neatsfoot oil and neatsfoot stearin may be obtained. From the raw bone gelatine, glue, tallow, and bone meal are made. Thus, while the chart represents approximately the ultimate disposition of the by-products, it should be remembered that further treatment is frequently practiced, even to the finished stage, as previously mentioned; also, that not all these by-products are made in all establishments. As the present conditions in this business, however, demand the utilization in the same plant of everything possible, the treatment of each product will be described.

12. Hide.—Of the varied by-products from the bullock, the hide is the most valuable. It is removed from the freshly slaughtered bullock on the killing floor, usually located on an upper floor of the building, and conducted by chutes to the hide cellar. The hide cellar, as the name indicates, is located in the lowest level of the building where there is a cool fairly even temperature with a minimum of artificial refrigeration. After being trimmed free from adhering flesh and fat, it is allowed to cool for several hours to eliminate animal heat. If this were not done and the hide salted more or less warm, decomposition would tend to ensue, which, while held in check by the salt, would so injure the fiber of the hide that the tanner would be unable to make good leather of it. When such decomposition takes place, it also destroys the epidermis of the hide, causing more or less of the hair to come off in patches, and thus making a *hair-slipped* hide, much deteriorated in value.

When cool, the hides are put into packs 30 to 40 feet square and several feet in height. Each hide, as it is spread on the pack, has spread over it a weight of salt approximately the same as that of the hide itself. While the hides are considered as cured after a month in the pack, they are often allowed to remain there much longer. The hides are then termed *green-salted* and are put into one of several grades depending on weight, size, brand, and general condition.

During the period of curing, considerable shrinkage takes place, the amount of which depends on the length of time in the pack, the condition at the time of going into pack, and the amount of moisture in the hide cellar. The shrinkage varies from 14.3 to 15.8 per cent. and may show a variation with the time of year.

A great deal of damage is done to hides by so-called *salt stains*, the true cause of which has not yet been determined. These stains may cause hides to go into cheaper grades of leather than would be necessary were they unstained, with a subsequent loss to packer and tanner. The best authorities seem to be of the opinion that the stains are caused by iron in the blood of the bullock. These stains are increased or exaggerated by resalting and by lying too long in the pack.

13. Head.—After removal from the body, the head is trimmed free from meat, which is utilized in the making of sausages and for canning. Owing to the very gelatinous, or glutinous, character of this meat, it is valuable also for use in making other food products, as meat loaf, etc., in combination with other materials.

The horns are sawed off. Horns constitute a very profitable by-product of the packing house, as they bring good prices. Inside the horn is a tough, porous, semibony filling termed horn pith, which is an excellent material for the making of high-grade edible gelatine. The piths are removed from the horns by means of hot water and are dried carefully.

14. The head is separated into the skull and the jaw bone, after which the brain is removed from the skull, if desired for edible purposes, and the skull is placed in a vat of hot water. The jaw bone is cracked, so that the tallow contained in it can be boiled out and placed in the vat with the skull. After accumulating a quantity of bones in this manner, they are washed so as to remove the adhering blood and dirt, and boiled with live steam for about 10 hours. After this the vat is allowed a period of rest to permit the tallow to rise. This treatment yields tallow which is removed from the top of the liquor, and a watery solution of glue known as glue liquor, the treatment of which will be described later.

The bones remaining in the vat are removed and subsequently freed from adhering meaty matter, washed, and dried on steam coils. They may be disposed of in this condition or they may be crushed by a bone crusher and made into crushed raw bone, or the latter may be put through a bone mill and ground into raw-bone meal. An analysis of this will show, approximately, ammonia 5 to 5½ per cent. and bone phosphate 55 per cent.

The meaty material from the heads and the small, thin bones left behind, are then put into a rendering tank, to obtain whatever tallow may be left in them. It has a titer test of about 41.5° C., the free acid, if the heads have been cooked fresh, not exceeding .5 per cent. Formerly, this tallow was frequently used for the making of oleo oil and for mixing with lard. Under the new regulations, it may still be used for the former product if suitable, but it cannot be mixed with pure lard unless the fact is plainly stated on the label.

15. Tongue.—The tongue is always removed before the head is used for the other by-products. As this is one of the high-priced by-products of the animal, it is always handled to produce the best results in the way of weight, appearance, etc. Tongues are frequently sold in the fresh state; they are also, after the necessary preparation, sold in a pickled condition.

After a period of curing in pickle, the tongues are often smoked after the manner of other smoked products and sold as smoked tongues. Differing from most of the by-products, the market demand for beef tongues is such that they are never tanked as surplus.

16. Liver.—The liver taken from the bullock has the gall bag removed and is then washed, hung on hooks to drain and chill thoroughly, and sold in the fresh state. Where a surplus of livers are obtained, they are tanked for fertilizer material, or tankage that will analyze about 15 per cent. ammonia and no bone phosphate. Livers when cooked yield no tallow; when tanked and rendered with tallow material, they always discolor the resulting tallow.

17. Heart.—After removal, the heart is cut lengthwise to a slight extent to allow the contained blood to escape from the interior. It is then washed in cold water and when thoroughly chilled is used for canning, mixed with other meat, for pickled goods similar to pigs' feet, for sausage, and very largely for the manufacture of beef extract. These processes will be described later. Hearts are also sold in the fresh state for food.

18. Tail.—The tail is chilled after removal from the bullock and is either sold fresh or utilized in the making of canned soups. At times the tails are chilled or frozen and exported. As they contain a large amount of gelatinous matter, they cannot be used for beef extract with any degree of success. Tails and all surplus of packing-house by-products when beyond the proper condition for food, ultimately find their way to the fertilizer tank.

19. Tripe.—In making tripe, the first stomach, or paunch, of the bullock, containing the undigested food, is utilized. This undigested food is removed and utilized for the making of strawboard. To illustrate the progress in the utilization of the various wastes of the packing house, it is not many years since the packers paid for having paunch manure hauled away from the premises. Later, it was run through large rollers, to remove all juices and moisture possible and then mixed with coal and burned as fuel. At the present time practically the entire output is utilized for the manufacture of strawboard, as just stated. The fertilizing value of this paunch manure is very slight, as it contains when dried only 2 per cent. of ammonia; its low specific gravity and bulkiness make it undesirable for fertilizer mixtures.

The paunch itself is washed in ice-cold water and all adhering fat is trimmed off. This fat when rendered makes a hard tallow having a titer of about 44° C., and a greenish-yellow color.

Following the operation of opening and cleaning the tripe on the umbrella washer, the old method of handling consisted of placing a quantity of the tripe in a tub where it was scalded for a certain length of time, then transferred from the tub to a table where the inner or mucous lining was removed by scraping with bell scrapers and knives. This operation required considerable labor and extra handling of the product, and the quality of the product was not uniformly satisfactory.

These objectionable features are overcome by a machine in which the scalding and scraping of the beef tripe is accomplished simultaneously. The tripe, after being washed in the umbrella washer is placed in the cylinder of the machine with a certain amount of water. The machine is then started and the water gradually heated to a temperature of 140° F. As the scalding progresses, there is sufficient agitation and scraping by the machine to remove mechanically the tissues that were formerly scraped off by hand.

This operation requires about 30 minutes and when it is completed the tripe is removed from the machine and placed in vats, where it is cooked for about 4 hours. It is then removed to tables where it is finished by trimming the edges, removing the thin outer covering and any remaining excess fat.

The product is then chilled, either by being placed in ice water or hung in a refrigerator room for a few hours. It is then packed in barrels or kegs and vinegar is poured over it which tests $4\frac{1}{2}$ per cent. acetic acid or 45 grain. After standing open for 8 to 10 hours, the vinegar in the barrels is brought up to the original strength by adding 90 grain stock, care being taken that the tripe is completely immersed. The barrels are then coopered for shipment.

20. Sweetbreads.—The sweetbread is the thymus gland of the animal and is characteristic of comparatively young animals. It has been found that cattle which have been fattened in feed lots yield much larger sweetbreads than Western or range cattle, being undeveloped in the latter because of their mode of living. In older cattle it practically disappears or becomes so shriveled in size as to be of no value. The weight of the full-sized sweetbread averages about $\frac{1}{2}$ pound. Sweetbreads are always sold in the fresh condition and constitute a very perishable product.

21. Beef Gall.—The beef gall, known in pharmacy as *fel bovis*, is frequently manufactured into inspissated ox gall. For this purpose the gall bladder is slit and the slimy, greenish gall is strained to remove the valuable gall stones. Although the yield of gall stones may amount to only a few ounces per month even in a large establishment, their sale price, which has reached the figure of $450 per pound, warrants their recovery. The stones are disposed of almost entirely to the Oriental races, who believe that they have considerable medicinal value.

The gall itself is collected and evaporated in an ordinary steam-jacketed kettle until a thick skin forms on top of the liquor. The original bulk is reduced about three-fourths when it is poured into shallow sheet-iron pans about 1½ inches high, 30 inches long, and 20 inches wide. At a temperature of 212° F., it is evaporated to dryness and kept in the drying room until wanted for grinding. As this material is very hygroscopic, this precaution is very essential.

The grinding, or powdering, is accomplished in a specially constructed mill which grinds out of contact with the atmosphere. Any machine that fills this condition is suitable for this purpose. The hard and brittle dried gall is removed from the pans only when wanted for immediate grinding. When sufficiently fine the gall is removed from the mill and at once placed in tin cans, which are immediately sealed air-tight by soldering.

The inspissated ox gall is used to a considerable extent for medicinal purposes. The liquid gall is employed in the manufacture of special soap for washing goods the dyes of which are loosely fixed. The liquid article is also used to a limited extent in fixing the dyes and colors of textile fabrics and carpets.

22. Feet.—In the packing house, the foot is that part of the leg from the knee joint to the hoof. After removal the feet are stripped of the sinew lying along the shin bone. The sinews are in most packing houses salted down and kept in this condition until sold to the glue manufacturer. They may be cooked by themselves in the packing house, where they are resolved into glue liquor yielding about 20 per cent. dry glue, 5 per cent. neatsfoot oil, and from 3 to 5 per cent. dry tankage (not including the large bones of the feet).

The feet are next passed to the bone sawyer, who removes the knee joint and the foot proper with the attached hoof, in both cuts exposing the marrow at the ends of the shin bone. The feet are then placed in boiling water for 15 minutes, after which they are removed, and the hoofs forced off by a machine known as a *hoof puller*, leaving them in condition to be boiled for oil, glue liquor, and bones. The hoofs are then either dried, to be sold in this condition, or made into hoof meal, which is described later.

The feet are put into open vats, washed free from blood, dirt, etc., and are then covered with clean water and cooked with live steam for about 10 hours, or until the bones fall apart and the oil separates. The glue liquor formed is cared for by the glue department, when in connection with the packing house, or it may be concentrated to a jelly and sold in this condition to the glue manufacturer. The bones washed free from adhering meaty matter are dried in this condition as raw bone, or they may be ground into raw-bone meal, as will be described further on. The ends of the sawed shin bones are boiled together with the feet, as they yield the same products. These ends are known as knuckles, and are utilized in the manufacture of bone black, as they are particularly adapted for this purpose.

23. The tankage, or refuse, from the boiled feet is generally recooked for several hours in order to obtain a further yield of oil. A set of four feet gives approximately ½ pound of dried, high-grade tankage. The oil that exudes from the feet in boiling is neatsfoot oil. This oil is collected from the vat, freed roughly from water and scrap by settling, and then placed in an open iron tank and heated to 220° F., to drive off all moisture contained in it. While hot, the oil is passed either through cotton-flannel bags or, where there are large quantities, through a filter press, to remove fine scrap, hair, and other extraneous impurities. The oil when cool is ready for sale purposes as pure neatsfoot oil, or it may be further manipulated, being made into neatsfoot, stearin, and winter-pressed neatsfoot oil. The latter process will be described later.

The sawed shin bones are also boiled in open vats with live steam to prepare them for cutlery bones. The marrow of these bones also produces neatsfoot oil, which is mixed with that obtained from the knuckle bones of the feet. The refuse from the meaty matter of the bones is sent to the pressure tanks to be further rendered with tallow material for any remaining fatty matter. The bones destined for cutlery purposes are cooked 5 or 6 hours at a temperature not exceeding 210° F., in order to retain as much of the gelatinous matter as possible, thereby keeping the strength of the bone more or less intact. It is important not to overcook these, as by so doing their value is reduced to that of raw bone. In proper condition after cooking and drying, these bones are worth from $50 to $80 per ton. The cooked bones, freed from oil and tankage, are dried on racks at a moderate temperature, about 70° F., and are ready for shipment.

The open tanks in which bones for cutlery purposes, etc. are boiled should be provided with a false bottom, either perforated or slatted, under which steam pipes are placed. Otherwise, any bones lying directly against the live-steam pipes are liable to be discolored or overcooked, conditions that should always be avoided.

Where these shin bones are not handled in this manner, if not desired for fancy bones, the whole shin and foot, except the hoof, is boiled together for the production of neatsfoot oil and raw bone, the tankage, as usual, being incidental. Raw bones of this description furnish a most excellent raw material for glue and gelatine.

24. Casings.—Casings are products made from the intestines of cattle, sheep, and hogs, primarily, however from cattle. Their systematic treatment results in a product as clean and sterile as possible and when stuffed with chopped meat and spices constitute the sausage of commerce. Beef casings include the intestines, namely, rounds, middles, and bungs, and also the weasand and bladder. The bung is the end of the large intestine which is cut off a length which varies from 4 to 8 feet, depending on the size of the cattle. In the center of this intestine should come the opening where the small intestine connects with the large. Beef middles are the large intestines of the bullock and vary in length from 20 to 38 feet. The middle lies between and is connected with the bung gut and the round intestine. The round gut is the long intestine of the bullock and varies in length from 100 to 140 feet. These intestines lie connected with and surrounded by a mass of fat, constituting a heavy apron-like mass called the ruffle.

In preparing the casings the round is first removed, then the middle, and finally the bung gut. These are first scraped free from fat either by hand or by the fatting machine, as the fat is of more value than the intestine itself. After *fatting*, the intestine is placed in cold water and turned inside out so that the inner slimy membrane may be removed. Since it is only the muscular portion of the intestine that is of value as the casing, it is essential that the cleaning process be carefully followed.

After cleaning, the intestines are measured into sets, the rounds of approximately 110 feet, and the middles of 62 feet These are then salted, piled on trucks to drain, and finally packed in fine salt in tierces preparatory for shipment. The rounds will measure now about 100 feet to the set and the middles about 57 feet. The bungs are handled exactly as explained, except that no attempt is made to arrange them in sets.

The weasand is the gullet, or lining of the throat, of the bullock and is a tough, translucent membrane. It is surrounded by or covered with a layer of soft, dark meat, which is stripped off and utilized in the manufacture of sausage. The weasands are then blown up with air, tied tightly, and hung up to dry, at a temperature of about 115° F. Narrow weasands are those which while drying have a weight of about 4 pounds hung on the end, drawing them out and making them narrower. These are blown less full of air than the regular weasands. When dry they are taken down, the ends cut off and the weasands bundled for shipment.

The bladder is freed from urine, washed, and trimmed free from adhering fat, the latter being utilized for tallow. The bladder is then blown to its fullest extent with air, and a string is tied around its neck while in this condition. It is dried at the air temperature, the neck cut off, flattened out, and sold in bunches of dozens. Bladders are used for the packing of putty. In England and continental countries they are sometimes used for the packing of lard and for various industrial purposes.

25. Fat.—Three classes of fat are obtained from the bullock, namely: oleo fat, edible tallow, and inedible tallow, which are further subdivided into several grades.

There are three grades of oleo fat, or more commonly, oleo stock, which are as follows: No. 1, or neutral; No. 2, and No. 3. The No. 1 constitutes the highest grade and is practically free from taste and odor. The No. 2 stock is slightly darker in color, has a distinct suety odor, and is not as sweet as the preceding grade. The No. 3 stock is much darker in color, has a stronger odor and cooked flavor, and is not as sweet as grade No. 2. These three grades are rendered, as will be described later, from the abdominal or caul fat, the ruffle fat, the kidney fat, the cod fat, the fat from the top part of the heart, and others of lesser importance, all being used in the manufacture of oleo oils and oleo stearin. The average bullock will yield from 60 to 75 pounds of this fat.

The second class of fat known as edible tallow is prepared from fat essentially as clean and wholesome as that used in preparing oleo fats, the only difference being that there are small particles of bone and meat attached to the fat. For this reason, it is necessary to render it in closed tanks under steam pressure whereas the oleo stocks are rendered in open kettles at low temperatures. Edible tallow is used as cooking fat and in the preparation of compounds with vegetable oils.

It is customary to prepare three grades of inedible fat, which comprise the third class of beef fats, as follows: No. 1 or extra prime; No. 2, and No. 3. Extra-prime tallow is light in color and low in free, fatty acid, and is used in the manufacture of lubricating oils and soaps. No. 2 tallow has a darker color and is higher in fatty acid and is used exclusively in the manufacture of soap. No. 3 tallow comprises the lowest grade of inedible fat, being dark in color and high in fatty acid. It is used in the preparation of the cheapest grades of laundry soap.

All fats derived from the direct slaughtering are known in the packing house as killing fats, to distinguish them from the cutting fats derived from the cutting up and trimming of the chilled dressed beef for the various cuts.

26. Horns and Horn Piths.—Among the important by-products of the bullock are the horns. The constantly growing practice of dehorning has caused the supply to diminish from year to year, and good horns are becoming scarcer each year. In spite of this fact, the value of horns has not been increased to any considerable extent owing to the fact that manufacturers use celluloid and similar compositions as substitutes.

27. The horns on the cattle heads are sawed off close to the skull after slaughter. To separate the enclosed pith in the horn, it is merely necessary to cook the whole at 160° to 170° F. for 30 minutes. The hot water is then replaced by cold water to cool the horns and make their handling easier. A heavy stroke of the horn on iron, or vice versa, will cause the pith to fly out. It is very important that horns should not be overcooked, as this will cause them to turn yellow and become brittle, thereby seriously damaging them. If, however, they are not sufficiently cooked, the pith cannot be removed without great difficulty. In this case, the horns must be reheated in the water until the proper condition for the removal of the pith is obtained.

After the pith is separated from the horns, the latter are sorted into various grades—steer, cow, bull, stags, stumps, and useless horns. Steer horns are the most valuable, and have a smooth surface both on the outside and on the inside. This is a convenient practical test for distinguishing large cow horns from steer horns. The weight of steer horns is small considering the size, varying from 40 to 100 pounds per hundred pieces. They are classed as No. 1 horns. All steer horns averaging below 40 pounds per hundred, and cows, bulls, stags, and stumps are classed by the manufacturers as No. 2 horns.

Stump horns are those of all grades from which the tip is absent or badly damaged. Stag horns are of a rough nature, weighing about 2 pounds each. Useless horns include all misshapen, overgrown, or irregular horns.

Horns will lose in drying about 12 per cent. of their original weight. They are stored in a cool place to prevent them from becoming too brittle. Horns are used for the manufacture of imitation tortoise shell, for combs, buttons, and similar articles, and for pipe-stem tips. The refuse horns, clippings, etc., are made into a fertilizer material called hoof meal

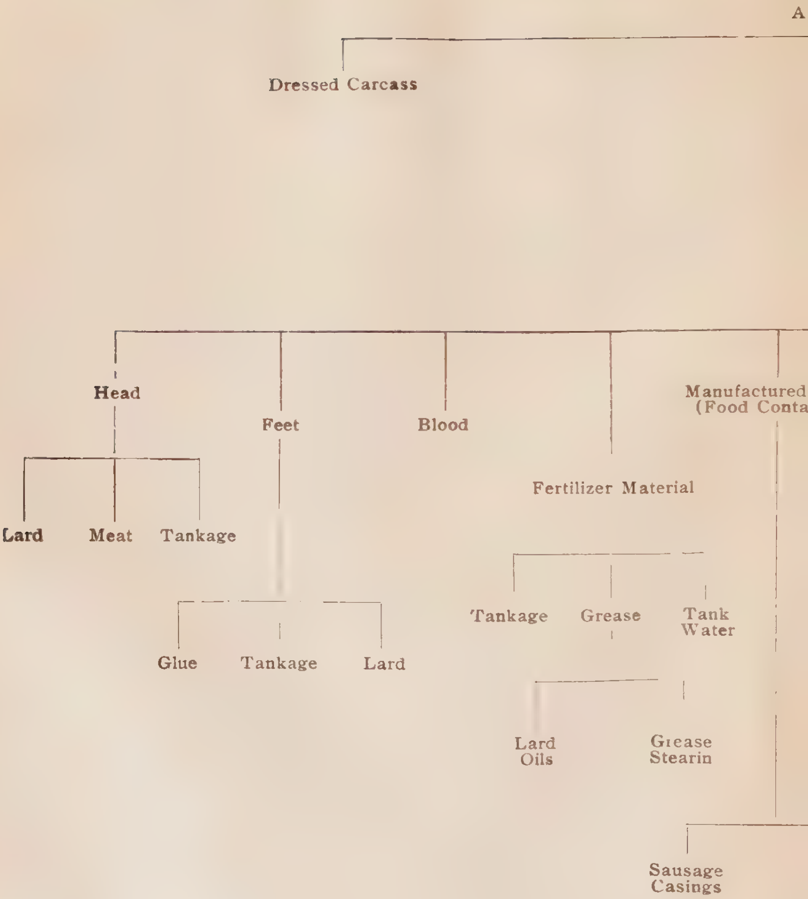
28. Horn piths, after being knocked from the horn, are stripped of the skin covering them and then dried on the floor at a moderate temperature. The cleaner this product is and the freer from bloody tips, the higher price it will bring. Horn piths are used extensively for the manufacture of edible gelatines and also as an excellent raw material for the glue maker.

29. Blood.—The blood from the bleeding bullock is conducted to a reservoir from which it is pumped to the cooking tank, or vat, in the fertilizer department. The liquid blood from the average beef is 40 pounds.

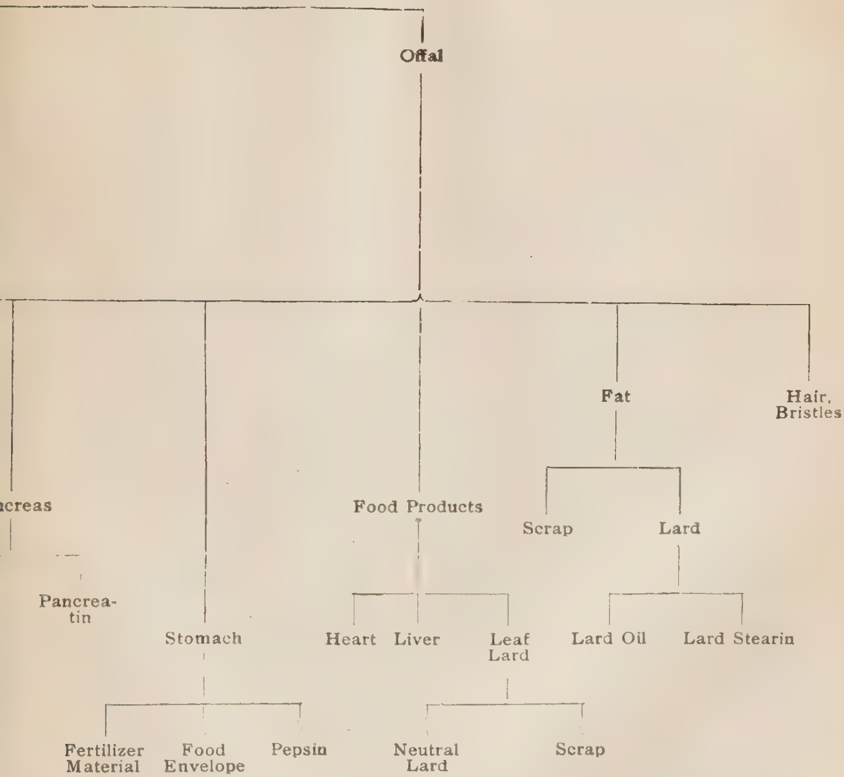
30. Fertilizer Materials.—All material from the slaughtered bullock not wanted or not suitable for other purposes may be classed as fertilizer material. It includes lungs, pecks (the third stomach of the bullock), spleen, and refuse from the manipulation of the other by-products in the packing house. Fertilizer materials also include all animals or parts of animals that are found on examination to be diseased or unfit for food. This material when rendered, furnishes tankage, tallow, and tank water, the latter being the cooking water heavily impregnated with nitrogenous compounds. Tank water is at the present time made into a fertilizing material by evaporation. This is known as concentrated tankage, or in the packing house as stick, the treatment of which will be described further on.

The foregoing products, as mentioned before, may be and are subdivided in many cases, but this subject is best treated under the different classes of products, where they are discussed more fully.

THE DISPOSITION OF A



THE PACKING HOUSE



HOG PRODUCTS

31. The dressed carcass of the hog is capable of many dispositions which depend on many conditions, notably the locality for which it is destined. The various methods of transforming the dressed hog into very numerous cuts, regulation and otherwise, is so complicated that personal observation and practice is far more valuable than description. The resolution and disposition of the offal is more complex than that of the bullock. The offal from the hog, comparatively speaking, is of more value than that of the bullock, as the finished by-products of the former are much more remunerative to the packer than those from beef.

32. The chart, Fig. 2, shows approximately the resolution of the hog into the most important packing-house products. The same is true here as with the chart of resolution of the bullock; that is, while showing the general result, many of the by-products may be still further divided when deemed profitable. All these by-products are not manufactured in every establishment, but in the largest packing houses which are conducted on scientific principles with the aid of chemistry, these, together with many allied products, are manufactured in very large quantities. As many packing houses handle hogs only, the utilization of every product possible under the circumstances is a necessary factor in obtaining satisfactory financial results. The disposition of the offal in the packing house will be described in detail.

The most important by-product, although not always considered as a by-product, is lard. The subject is so important and the treatment and manufacture so varied that it will be treated under a separate heading.

33. **Head.**—The head of the hog after removal at the time of slaughter is thoroughly washed in water so as to remove the blood and dirt. Several dispositions are made of this product. In all cases, the tongue is removed and treated by itself. The heads are scraped free from all hair and bristles, washed thoroughly clean in cold water, and chilled for 24 hours, when they are ready for sale. At times, they are split in halves and pickled in strong brine for 2 weeks, when they are packed in barrels for shipment, mostly to tropical countries. When intended for lard purposes, the heads, after being cleaned and washed, are sent to the rendering tank with other suitable material and cooked for lard.

Another use for the heads is the manufacture of headcheese in the sausage department. Here they are cooked in open vats until the flesh loosens when they are removed and the bones separated from the meat. This meat, together with the skin of the hog or similar glutinous matter for adhesive purposes, is made into a chopped mass with other materials, stuffed into cleaned hog stomachs, and then cooked in practically the same manner as sausages. This latter use is the most profitable for the packer, as by it he obtains lard from the cooking of the heads, the meat for a profitable use, and the bones for fertilizer.

34. Blood.—The blood from the slaughtered hog is conducted to a reservoir and treated the same as the blood from cattle, as will be described later.

35. Food Products.—Broadly speaking food products include almost every part of the hog. With the exception of the gall, bones, and bristles, all parts may serve as edible products. Specifically, they will be treated here as the heart, liver, and leaf lard, the latter finding its most important use as neutral lard and as a component of oleomargarine, or butterine.

36. Heart.—The heart finds its most important use in the production of sausages. It is frequently sold attached to the liver and lungs by a short piece of windpipe, the whole being technically termed the *pluck*. When not desired for these food purposes, it is sent to the tank and rendered for fat, the fleshy residue furnishing a fertilizer material rich in nitrogen.

37. Liver.—In the United States, the liver of hogs finds restricted use as food, but in many foreign countries this is its only utilization. The fresh livers, preserved in a solution of salt, borax, and boracic acid, were largely sent abroad from the packing centers, arriving at their destination many days afterwards in a condition hardly distinguishable from the liver freshly removed from the hog. Of late years, however, this disposition has been greatly restricted, owing to the passage of stringent laws in many foreign countries against the importation of such meats packed with preservatives.

Hog's liver is very serviceable as a component of piquant table sauces, although its use is limited. The livers are also cooked, dried, and then ground into a powder and used as a component of dog biscuit. This outlet is at times a very important factor in disposing of a surplus. When not desired for other purposes, the livers are cooked under pressure, when they yield only tankage and tank water. The tankage from livers when dried, contains about 14 per cent. of ammonia and furnishes a readily and easily available source of nitrogen in fertilizers.

38. Leaf Lard.—Leaf lard when removed from the hog is chilled, as described later, when intended for the making of neutral lard. For sale purposes, it is hung from the middle of the piece on slanting pegs about 6 inches long, and allowed to chill in this condition. When removed, and with the skin side exposed, it presents a smooth, cone-like homogeneous lump.

39. Feet.—The feet after removal from the dressed hog, which has been chilled for about 48 hours, are sometimes sold in the fresh state after being thoroughly cleaned and freed from all hair and the horny toes. These toes, after being cooked under pressure to loosen the tissue so that they may be easily ground, are sent to the fertilizer tank. They furnish a fertilizing material containing about 19 per cent. of ammonia. This material is generally mixed with the ordinary tankage from hog offal to raise the grade in ammonia. The small projections on the back part of the feet, called the *haws*, corresponding to the dew claws on cattle, also have their horny covering removed, the material likewise furnishing fertilizer stock. The feet are also cleaned and cooked for 2 hours, after which they are split and placed in packages with vinegar and spices. For this purpose, the feet are first subjected to pickling in a solution of salt and water for 2 or 3 weeks. They are sold as pickled pigs' feet.

When not desired for food purposes the feet are cooked under pressure for lard and tankage. The lard obtained in this manner is of a very oily nature, consisting of a large per cent. of olein and very little stearin. It may be mixed in cool weather with ordinary lard, when its oily characteristics are not apparent. Pig's-foot lard furnishes on pressing into oil and stearin a very large yield of lard oil, and is very frequently utilized for this purpose. The yield of lard from feet is about 16 per cent. The most profitable use of pigs' feet for commercial products is for glue, which product is largely made in the Chicago packing houses. The front feet of the hog are usually employed for making pickled pigs' feet, while the hind feet are used for glue material and lard.

40. Kidneys.—The kidneys are always removed from the slaughtered hog. The beef kidneys are always left with the dressed carcass, embedded in the kidney fat. Hog kidneys find extensive sale in the fresh state. The surplus goes to the rendering tank.

41. Hair and Bristles.—The hair and bristles of the hog furnish by-products of extensive utility. As the slaughtered hog emerges from the scalding tub, the bristles are selected from along the ridge of the back and the hams. They are chosen as to length and color, the black, brown, and white being kept separate. The hair and bristles are almost always sold by the packer to contracting firms at a certain price per hog. The season of the year, by virtue of the condition of the hair and bristles, largely influences this value. The contractor always takes care of the product, and furnishes all labor required for selecting, removing, curing, etc. The hair and bristles are spread in fields to dry, when they are packed with salt and brine in barrels and bags and sent to the brush manufacturers. Hair that is not suitable for this purpose is sold and made into a cheap grade of curled hair which is used for mattresses and for padding horse collars, cushions, etc.

Owing to the high percentage of nitrogen in hair, recent developments are toward the utilization of the cheap and ordinary hair for the production of nitrogen, in a soluble or available form, by dissolving it with acids or other suitable agents.

42. **Food Containers.**—The same may be said of manufactured goods of pork as was said of those of beef. From the hog they include sausage casings and bladders. The bladders are prepared by voiding and then soaking in cold water and brine for a day, when they are trimmed free from fat, distended with air to their fullest extent, and dried at a temperature of 140° F. for 24 hours. After expelling the air and folding lengthwise they are ready for use. The rough end, where they are tied shut, is cut before packing for shipment.

Bladders of hogs find extensive use abroad for packing lard for sale purposes. They are sometimes colored and used for carnival purposes. Formerly bladders were largely employed for packing snuff. When parchmentized by means of dilute sulphuric acid, they are used for the covering of glass-stoppered jars and bottles.

43. **Casings.**—Hog casings are classed as hog casings and hog bungs, the latter being the last 4 feet, or thereabouts, of the intestines. These, again, are graded according to length and condition. They are thoroughly cleansed inside and out and salted to preserve them, as is done with the beef casings. There is a marked distinction between the texture and appearance of the hog bung and the beef bung. The former is of a close, compact, and solid texture, with a white, opaque appearance. The beef bung is of a fibrous, heavily veined structure, and is of a yellowish, transparent or translucent appearance. The hog bung is almost universally employed for liver sausages, while that of the bullock is used for bologna sausages.

Hog casings are made from the small intestines of the hog. The preparation of these differs from the manner of preparing the corresponding beef intestines. They are allowed to ferment for a day in warm brine, to loosen the attached mucous coating. This fermentation has been found by experience to be a necessary procedure. It thoroughly and easily removes the mucous membrane and accompanying slime. Another day's soaking in moderately cold water prepares them for cleaning, which in small establishments is done by hand; in large ones, by machinery. The treatment of the intestines after cleaning is carried out the same as that of the beef casings, as has been described. This intestine of the hog varies in length from 40 to 75 feet and, unlike that of the beef, is not fat nor embedded in fat, but simply attached to it. The yield of casings per hog is about $\frac{1}{4}$ pound, and the use is for high-grade sausages. The refuse and useless intestines are tanked under pressure for fertilizer material.

44. Stomach.—The stomach of the hog when voided, scraped, and cleaned furnishes an envelope for filling with sausage material such as headcheese. After cleaning, the stomachs are preserved in a strong solution of salt and water until used.

The stomachs are also the source of a most important product—pepsin. Most packing houses do not make this finished product, but prepare the stomachs by cleaning them thoroughly and shipping them to the pepsin manufacturer in a solution of borax and boracic acid, or better, in a frozen condition. When stomachs are not used for the purposes just mentioned, they are cooked under pressure for fertilizer material, furnishing tankage similar to tripe from bullocks.

45. Pancreas.—The pancreas, or sweetbread, furnishes the digestive ferment pancreatin. This product is made only by some of the largest packers. In establishments of moderate size the pancreas is usually tanked with fertilizer material.

46. Fat.—The fat of the hog suitable for lard material is cooked for the production of lard of various kinds. All fresh and clean fat of the hog in sound condition is suitable for this purpose. All fatty refuse material not suitable for lard is cooked under pressure, producing grease and fertilizer material. Such material is found in the refuse from cleaning intestines, in catch basins, etc.

47. Fertilizer Material.—The fertilizer material of the hog consists of all material that is not wanted or is not suitable for food or other purposes. Products that have become unsalable or have deteriorated are also made into this material and the accompanying grease recovered. During the operation of dressing the slaughtered hog, many parts become so soiled as to be unfit for meat or lard, and these, together with all meaty and fatty material, are sent to the fertilizer tank. Clotted blood, the spleen, rejected intestines, etc., also furnish this material.

Hogs condemned by meat inspectors on account of disease or unsuitable condition at the time of slaughter are also sent, viscera and all, to the fertilizer tank and rendered into grease and tankage. The water in which all meaty or nitrogenous animal matter is cooked under pressure is known as tank water, with the characteristics previously described.

The products of the hog mentioned are the principal primary ones. As with beef products, these may be still further resolved. For example, lard and grease are made into lard oils and stearins. This subject will be treated later.

CALF PRODUCTS

48. When possible, calf products are disposed of in a manner analogous to those of beef. But the by-products of the calf are very limited, as about two-thirds of the live weight is disposed of as dressed meat. Calves are almost always sold with the skin, or hide, attached to the carcass.

The viscera and internal organs of the calf, together with the legs and head, form the by-products. From the entrails and fat are produced a small quantity of tallow and tankage. No sausage casings are made from the entrails of calves, as their tender condition renders them entirely unsuitable for handling.

The feet yield a small quantity of neatsfoot oil and when utilized for glue furnish a rich material for gelatine. A very limited demand exists at times for the cleaned feet in the fresh state, for edible purposes.

The heads are sometimes cleaned, scalded, and prepared for food purposes. Where this is not done, they are tanked with the fertilizer material. They also furnish a serviceable glue liquor.

The tongue is always removed from the head and is either sold in the fresh state or cured and sent to the canning department.

Calf sweetbreads always find a ready sale as a table delicacy and bring very high prices. The brains are frequently removed from the heads and also sold as delicacies.

The blood and worthless offal are made into the usual fertilizers.

The heart, liver, and lungs attached to a piece of the windpipe, together known as the pluck, are always sold in the fresh state for food purposes.

Unborn calves, known technically as slunks, are skinned when the hide is covered with hair. The rest is made into fertilizer.

SHEEP PRODUCTS

49. In slaughtering sheep, the usual method is first to cut the animal's throat, severing the jugular vein, and then to break its neck by bending its head back sharply. After the slaughtered sheep is dressed, the warm abdominal fat—the thin, apron-like sheet known as the *caul*—is wrapped around the carcass, encircling the hind quarters as much as possible. The kidneys attached to the body are pulled through a slit made in the warm fat, and the carcass allowed to chill in this condition.

50. The offal of sheep is not so diversified as that of the hog or bullock, and is not subdivided to any considerable extent. The intestines are utilized in the manufacture of sausage casings, in the same manner as those of the hog and bullock, and in addition they are used in preparing tennis and musical strings, and surgical sutures.

The hearts are used for the making of sausages, a large number, however, being sold in the fresh state.

The livers formerly found a large sale as *calf* livers. They are now sold under their proper designation. A distinguishing characteristic most frequently present in sheep liver is the occurrence of hard lumps, or cysts, scattered throughout the organ. These are never present in the liver of the calf. The livers that cannot be sold in the fresh state are tanked for fertilizer.

The lungs are always tanked for fertilizer, when not sold as sheep pluck, this being the heart, liver, and lungs attached to a piece of the windpipe.

The heads are either tanked under pressure or boiled in open vats for the production of mutton tallow, when in quantity. In the latter case, the residue remaining in the vats is further cooked in the pressure tanks, as a considerable quantity of tallow always remains in the material after this mild cooking. The heads are otherwise cooked with the rest of the fertilizer material of the establishment for tallow and tankage.

The tongues are always removed from the head, and find their outlet as pickled lambs' tongues. Frequently, they are canned under the same name.

The feet when cooked by themselves yield a dark-red oil, analogous to No. 1 neatsfoot oil. A test made on sheep feet for oil and tankage gave 4.54 per cent. of oil and 24 per cent. of dry tankage of low grade. Unless a large quantity of material of this nature is always on hand, the feet are cooked with other fertilizer material.

Lamb fries is the trade name given to the testicles of sheep. They are sold in the fresh state under this name.

The paunches emptied of manure are utilized for fertilizer material, as is also all other offal not otherwise used.

The pelts of sheep are removed after slaughter. These are either disposed of fresh or made into packs with salt sprinkled between each skin for the purpose of curing them. In the largest packing houses, the wool is pulled from the pelt in a department known as the wool-pulling house. Here the pelts are treated with a depilatory which after a period loosens the wool from the skin and allows of easy removal. In the greater number of establishments, however, the pelts are sold as before mentioned.

Spring lambs are always sold with the pluck attached to the carcass and with the skin, or pelt, left on.

Unborn lambs, if provided with wool, are skinned and the remainder is cooked for fertilizer. The skin of unborn lambs furnishes a most excellent material for the manufacture of parchment or vellum.

The tallow obtained from sheep product is described further on.

GOATS

51. The slaughtering of goats is carried out in the same manner as that of sheep, as is also the dressing of the carcass. Their by-products so far as possible are handled like those of sheep. While in the aggregate a great many goats are annually slaughtered for food, their number is not as yet of sufficient importance in any one establishment to classify their by-products under their own nomenclature. The carcasses of goats dressed like sheep were formerly sold in the trade as mutton.

PROCESSES FOR THE MANUFACTURE OF LARD

52. Lard is the rendered fat of the hog. The several grades of lard produced by the packing houses are made by quite different processes and the care of operating depends on the grade of lard, although careful attention to details is always of the utmost importance.

The cheapest grade is steam-rendered lard; that is, the lard extracted from the stock by the direct contact of steam under pressure. Kettle-rendered lard is lard extracted in kettles heated externally, and is the highest grade of household lard. Neutral lard is made by a more complex process.

The importance and value of this product are so great constituting as it does the largest by-product of the hog-killing branch of the business, that the methods of production will be given in detail. Many small points, while seemingly of little moment, are of the utmost importance in the treatment of this material. The production of a high-grade article by proper cooking and handling is not only economical and advantageous, but it also obviates the too frequent after-treatment necessary to make a marketable lard.

STEAM-RENDERED LARD

53. Rendering Tank.—A modern rendering tank is shown in Fig. 3. The body *d*, the top d_1, and the conical bottom d_2, are made of steel or iron, riveted. The head *a* of the manhole is held in place by the clamp *b* and nut *n*. The pipe *h* is the exhaust leading to the condenser. The steam gauge *k* indicates the pressure in the tank. Steam is admitted to the tank through the pipe *l*, the pressure being controlled by the valve *m*. The valves *e* are for drawing off the lard. The petcock *f* is for the escape of gases during cooking. The gate valve *g* is for the removal of cooked meat, etc.

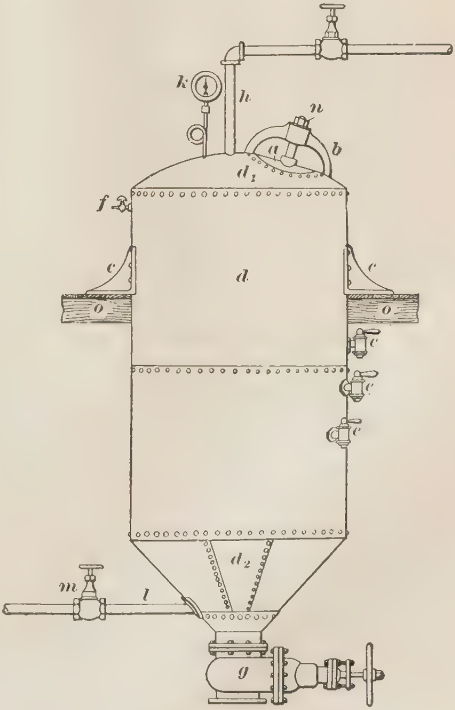


FIG. 3

This tank is a marked improvement over the old-style tank, which is constructed with cone top and cone bottom. The apex of the bottom cone in such a tank, being always below the lowest of any draw-off cock, or valve, forms a receptacle in which the foul drainings from previous renderings collect, and is a most fruitful source of discolored lard or other material unless great precautions are taken to remove this condensed liquid completely. In the modern construction, this great disadvantage is overcome, as may be readily seen. There are, however, a great many cone-bottomed tanks in use today in packing houses, but they are being replaced by tanks of the newer style.

Many of the old-style rendering tanks have in them at the top of the cone or rounded bottom, false bottoms of perforated iron. The object of such a bottom is to keep the raw material from packing below the entry point of the steam, where it would escape cooking to a great extent. Another point with the false bottom is that it allows the water to percolate through it, retaining the solid material on top and level with the door, or gate, which, in this style tank, is about 15 inches square in the body of the cylindrical part of the tank. Through this gate the solid cooked material is withdrawn by means of long, bent forks. Naturally, there is considerable labor attached to this operation, which in the modern tank without a false bottom is entirely eliminated. The whole contents of the cooked tank is completely removed in a very few minutes by simply opening the large bottom valve *g*. This saving of time and labor during the busy seasons in the packing houses is of great importance. Under the old system, serious delays were frequent, because the tanks were not cleansed and made ready for fresh material.

54. The rendering tank is usually from 5 to 6 feet in diameter and from 14 to 16 feet high. The modern tanks are made of steel instead of iron and the cylindrical shell is made of two rings. The idea of modern construction is to have as few seams as possible in the whole tank and to have the inside laps of the circular rings so arranged that they point down rather than up. In this way material that in a short time generates fatty acids that will rapidly corrode the seams, is prevented from lodging on the edge of each ring.

A suitable combination of wood made impermeable to moisture or other material should be on the charging floor surrounding every tank, as by this means drippings of water and washings from the floor will be prevented from running down the sides of the tank.

In the old-style tanks the bottom rested on a timber framework; this proved objectionable because it prevented access to the bottom plates and at the same time encouraged corrosion by keeping a wet surface constantly in contact with the iron. In modern construction the tank is suspended entirely free from the floors *o*, Fig. 3, except where supported on the lugs *c*. By this method, the external surface of the tank is always visible for inspection and kept free from corrosion.

55. Precautions for Safety of Tanks.—Rendering tanks in large cities are subject to the same regulations regarding inspection as steam boilers. Even where municipal inspection is not obligatory, the packers have the tanks periodically tested and inspected. If the slightest flaw or weakness is detected, the tank is immediately put out of service until it is made thoroughly safe.

The rendering tank is of such importance in the packing and rendering industries that the greatest care is taken in its construction. The life of the ordinary rendering tank is to a great extent dependent on the class of material cooked in it and the care it receives in handling. With good usage the average tank will last about 20 years.

56. Operation of Steam Rendering for the Production of Prime Steam Lard.—The rendering tank must be thoroughly clean on the inside. When a new rendering tank is first put into service it is always used for cooking grease material in order to remove all rust, oil, dirt, and other extraneous matter incidental to its making. If this plan is not followed the lard coming from the new tank will always be more or less dark and discolored and most likely will have an *off* flavor. This method of cleaning a new tank is always followed in the packing houses.

Where the cone-bottom tank is used, great care should be taken to remove all the old tank water or other material from the apex of the cone. Clear water is run into the tank until it is about one-quarter full. The material is then dumped in, care being taken, however, that the fat does not pack where it strikes inside the tank. Packing is a prolific cause of *cold spots*, and consequently of sour lard, and may be avoided by distributing the material evenly over the interior of the tank with a long pole.

The stock in the tank is thus washed while being *loaded*, as the filling is technically termed. To further this washing, a stream of cold water from a hose at the top of the tank is kept running over the material and, at the same time, in order to maintain the same level of water on the material, an equal amount of water is allowed to escape at the bottom. A great deal of blood from the material is in this way eliminated. The more washing lard material receives prior to the cooking, the better will be the quality and color of the lard produced.

When the tank is about three-fourths full of stock ready for cooking, the flow of water is stopped both at the top and the bottom, and the head is put into the tank. This head, similar in shape to a manhole cover, is screwed down tight with a wrench that should not be longer than 18 inches. When the joint cannot be made tight with that leverage, the head should be removed and refitted with better packing. To force the head on with a longer leverage frequently results in a fracture of the mouthpiece or frame, and when steam is turned on in such a case, the tank is liable to burst and cause loss of life and property.

57. When the tank is properly closed, steam is turned on. The steam is allowed to enter the tank under full pressure, which is generally from 40 to 50 pounds. The safety valve is now tested to ascertain its free working. This valve should be so regulated that it will blow at the maximum pressure used for cooking the material. The exhaust pipe on the top of the tank is kept wide open until the pressure gauge shows a pressure of a few pounds, when it is almost but not entirely closed, to allow the steam pressure to rise to the maximum.

The petcock *f*, Fig. 3, at the top of the tank is always kept open while cooking to allow the gases generated by the cooking material to escape. These gases are a mixture of hydrocarbons and sulpho gases, of which hydrogen sulphide forms a large part. These gases, if confined while cooking the lard, would so impregnate it that the lard produced would be of an obnoxious flavor and unsalable as first-class product or standard lard.

58. When the steam-pressure gauge shows a pressure of 35 pounds the steam supply is partly shut off so that the incoming steam is balanced by that escaping from the petcock and the now partly closed exhaust pipe. In this way, the steady pressure desired for cooking is maintained. It is very essential in cooking lard that a steady pressure be held with the steam, as in this way a uniform product can always be obtained.

From 15,000 to 20,000 pounds of lard material, which will fill the average packing-house tank three-quarters full, should be allowed to cook at a pressure of 35 pounds for about 11 hours, the time being reckoned from the time that this pressure is obtained. With the tank only half or quarter full of stock to be cooked, a reduction of time of cooking and also of pressure must be made. Thus, with the tank quarter full, a pressure of 25 pounds for 9 hours will be sufficient, while with the tank half full a cooking of 10 hours with a pressure of 30 pounds will serve the purpose. The pressure employed, as well as the time of cooking, varies in individual packing houses, according to preferences and experience. For example, some prefer to render lard at a pressure of 40 pounds for 9 hours, which, in some cases, gives equally as good results.

59. The object of cooking raw lard material under pressure is to cause complete breaking up of the membranous cells enclosing the fatty material, thus allowing the oily material to escape from its coverings, and to cook thoroughly the fleshy portions, so that what little of this remains in the rendered lard is in a large measure prevented from decomposing. Incipient putrefaction of the raw material is thus prevented; hence, the great importance of rendering all material in as fresh a state as possible.

One of the most vital points in making lard is to start with the material in the proper condition, that is, as clean as possible. This applies more forcibly to the lard material from the killing of hogs than to the cuttings from chilled hogs that are made into customary cuts of hog product for the trade. The stock from freshly slaughtered hogs should be washed thoroughly so as to free it from blood and natural filth. If this is not done the rendered lard will have a dark, brownish color and a disagreeable, strong, pungent odor. Such lard will not pass the usual inspection required for the sale of lard or the requirements of the various boards of trade or chambers of commerce. (See Art. **92.**)

60. During the progress of cooking, the operator examines by feeling the outside surface of the tank, to ascertain whether or not the material inside is being heated equally. Should any part of the tank be cold, it shows that the stock is packed solid in that part and that the steam is merely cutting a channel for escape through it. This is technically known as a *cold spot*, and, unless remedied, gives rise to sour or putrid lard. The remedy consists in immediately shutting off the live steam and allowing the tank contents to settle for a short time. Then, from the valve in the back part of the tank, the water is drawn off until the lard appears. The valve is then closed and the steam again allowed to enter with full force. This procedure breaks up the compactness of the mass and disintegrates the material so that the steam then acts on each piece. The pressure is then regulated in the manner already described.

It frequently happens that more material is placed in the tank for cooking than should be. In this case, while cooking, the tank becomes flushed, that is, the partly rendered lard with the steam and water is blown through both the petcock and the exhaust pipe, causing a serious loss of lard. This trouble can be remedied by shutting off the steam and drawing off from the tank by means of the back valve sufficient partly cooked material and water to reduce the level of the contents of the tank below the point where the lard is blown out. The back valve is then closed, the steam again applied, and the cooking proceeds in the regular way.

The partly cooked lard which is drawn off is placed in the next tank of lard material to be cooked and the rendering of it completed. Flushing is a very common occurrence and is the cause of great losses in this branch of the business especially in the busy and crowded season when the tendency is to overload and crowd the tanks so as to take care of the large quantity of material.

61. After the cooking is completed, the steam is shut off and the petcock is opened wide to allow the pressure to escape there as much as possible. At the same time the exhaust is closed, as are also the escape valves. The object of this is to prevent the rolling of the contents of the tank, and the consequent forcible projection of the rendered lard through these openings. If there is no sign of rolling, the blow-off and escape valves are opened a little at a time, observing carefully that the contents do not roll. If the rolling occurs, these valves are shut and a short waiting period allowed until the cooked material has come to rest. After having blown off through the petcock about 30 minutes the steam is allowed to escape as rapidly as possible, the safety valve being opened to assist in this operation. The object is to reduce the pressure in the tank as rapidly as possible, so that no lard will blow away with the steam.

After the pressure is gone, and not before, the head of the tank is loosened and allowed to hang in the manhole. The escape and blow-off, or exhaust, valves are then closed to prevent any induced suction from drawing the condensed liquid (made by condensation of the gases) from the exhaust pipe back into the lard. This is a most frequent source of the discoloration of an otherwise perfect lard, and is a point to be carefully guarded against.

62. The rendered lard in the tank is allowed to rest for a period of several hours to enable the fine, cooked fiber distributed throughout the lard to settle with the meaty material in the bottom of the tank. About 10 or 15 pounds of common salt is scattered on the surface of the lard, the object being to assist mechanically the fine scrap to settle. It also serves another purpose: The salt in passing through the lard comes in contact with the water, or moisture, still saturating it. A union of the water and salt immediately takes place and forms brine, which, being so much heavier than lard, immediately sinks through it, thus eliminating to a large extent the moisture in the lard. The sprinkling of the salt materially shortens the time required for the necessary separation of the rendered lard from the water formed by the steam and the scrap and fine particles of meat scattered through it. The longer the time within limits allowed for settling, the better will be this separation and the better will be the quality of the lard when drawn from the tank.

63. When ready for drawing, or tapping, the lard from the tank, the water underlying the hot lard is withdrawn through the valve in the back of the tank near the bottom. This brings the lard down to the level of the valves *e*, Fig. 3, in the front of the tank. The level of the lard is lowered until on withdrawing from the front valves, the lard issues from them clear and free from scrap, when the valve in the back is shut, and the clear lard run from the tank to the usual receptacle. After all the rendered lard has been withdrawn, the lower gate, or drop bottom, of the tank is opened and the residue in the tank is allowed to run into the vat underneath the tank. The lard obtained by this process of cooking is prime steam lard, and constitutes the main output of lard from the packing house. The cooked material remaining in the vat is then prepared for fertilizer, the treatment of which will be described later.

64. After the contents of the tank is dropped into the vat there is always more or less lard with it that rises to the surface of the tank water. It is not practicable or even advisable, to draw off the rendered lard from the tank completely, as there is always danger of drawing off some of the tank water with it. Unless lard is completely free from tank water, it will become sour, or decomposed, very quickly. As a matter of precaution, the flow of lard from the tanks is stopped when above the surface of the tank water inside, and whatever lard remains is allowed to mix with the tankage and tank water in the vat below, from which it is skimmed as it rises. This lard mixed with water and some scrap is technically known as skimmings. These are returned to another tank of lard material when about to be cooked.

65. Material from which prime steam lard is derived is made up of killing lard and cutting lard, so called in the packing house. The former consists of the fresh, fatty material from the slaughtering, such as the heads, gut fat, ham facings, various trimmings, etc., and yields from 40 to 45 per cent. of prime steam lard when rendered. Cutting lard consists of the trimmings, back fat, etc., obtained from the various parts of the chilled carcass. This almost clear fat when cooked for prime steam lard will yield from 70 to 75 per cent., depending on various conditions.

From the average hog 8 pounds of lard is usually obtained from the killing fat and 22 pounds from the cutting fat, although the amount of back fat used with this material naturally influences the yield. The grease obtained from the average hog will be about ½ pound, or about 1 per cent. of the raw material.

66. New Rendering Method.—The apparatus employed in the usual methods of rendering in the packing house has seen little change in form or improvement until recently. The sanitary authorities were nearly always in conflict with the renderer because the gaseous compounds unavoidably evolved in the rendering contaminated more or less the neighboring atmosphere. Within the last few years, a most excellent rendering system has been evolved that is destined in a very short period to supersede entirely the usual rendering apparatus in the small and medium-sized plants, and in all probability, those in the largest packing houses. This system is known as the Wannenwetsch combination sanitary rendering and drying system, and is so immeasurably superior to the old-fashioned rendering apparatus that a detailed description will be given.

67. Fig. 4 illustrates a complete unit for rendering the fatty material, pressing the resulting tankage, or scrap, and drying the latter. This entire work is done in only one handling of the material and all operations are carried out in the same apparatus.

The tank proper *a*, Fig. 4, is constructed very substantially, having heavy cast-iron heads in both the top and the bottom, in distinction to the usual riveted sectional head in the ordinary tank. The lower part of the tank *b* is made jacketed for steam pressure. The tank is provided in the interior with an agitator, which consists of a casting with blades that are actuated by the shaft and gearing *c*. A section of the agitator is shown at *d*.

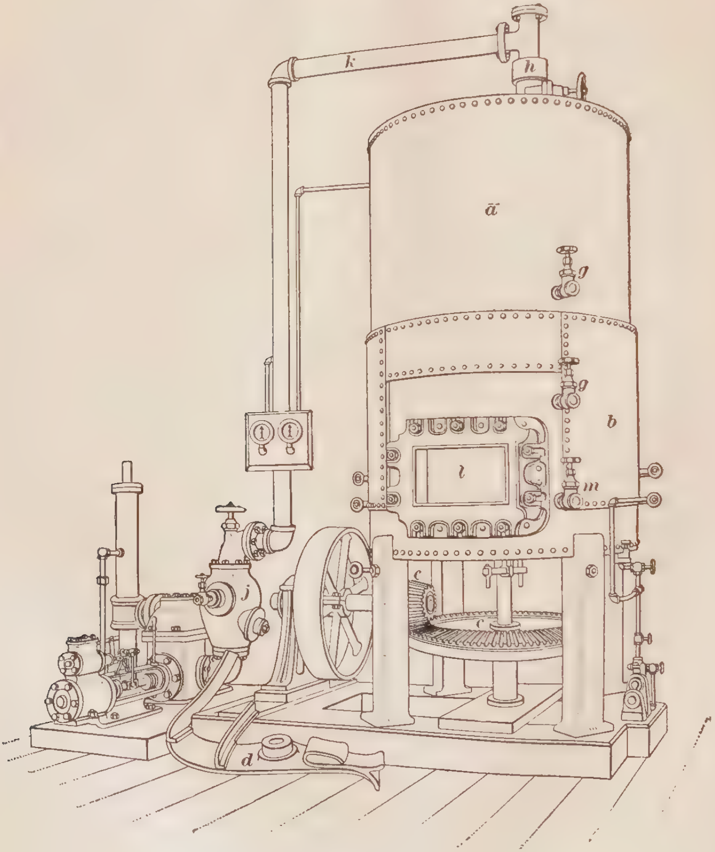


Fig. 4

68. Operation of Wannenwetsch System. — The material to be rendered is loaded in the usual manner, through a door in the top of the tank. The door is then closed and made tight, and steam for rendering is admitted into the tank at a pressure of 40 pounds. The cooking is continued for from 2 to 4 hours, the time depending on the character and quantity of the material to be rendered.

The agitator inside the tank is now set in motion for about 15 minutes. This operation together with the cooking causes the destruction of the fat cells and disintegrates any bone present, thereby causing the fatty matter to be liberated. The cooking is continued for about 2 hours longer, when the agitator is again operated for further disintegration of the material.

The steam is now shut off and the pressure is allowed to exhaust by means of a by-pass into the vapor line *k*, Fig. 4. The obnoxious gases (complex hydrocarbons, etc.; see Art. **57**) always generated in rendering are drawn through a spray of cold water into the vacuum condensing chamber, the non-condensable gases being conveyed to a gas-collecting chamber from which they are usually conducted to the furnace grates and burned. After all pressure is removed from the tank, the rendered lard, tallow, or grease is drawn off in the usual manner through the cocks *g*, *g* into settling tanks, or coolers.

69. After all fatty material is drawn off, all lard cocks are closed, the 4-inch valve *h* leading to the air pump *j* and jet condenser is opened, and the tank *a* is exhausted through the pipe *k* to a 25-inch vacuum. The residue, consisting of tankage and tank water, remains in the tank for drying, contrary to the usual operation of dumping the contents after rendering

Steam is now turned into the jacketed lower part *b* of the tank, and the agitator is set in motion so as to prevent the material from baking or sticking to the heated surfaces and to assist the rapid evaporation of the moisture. By means of the testing valve *m* the material may be examined from time to time to ascertain its condition without any interruption of the operation.

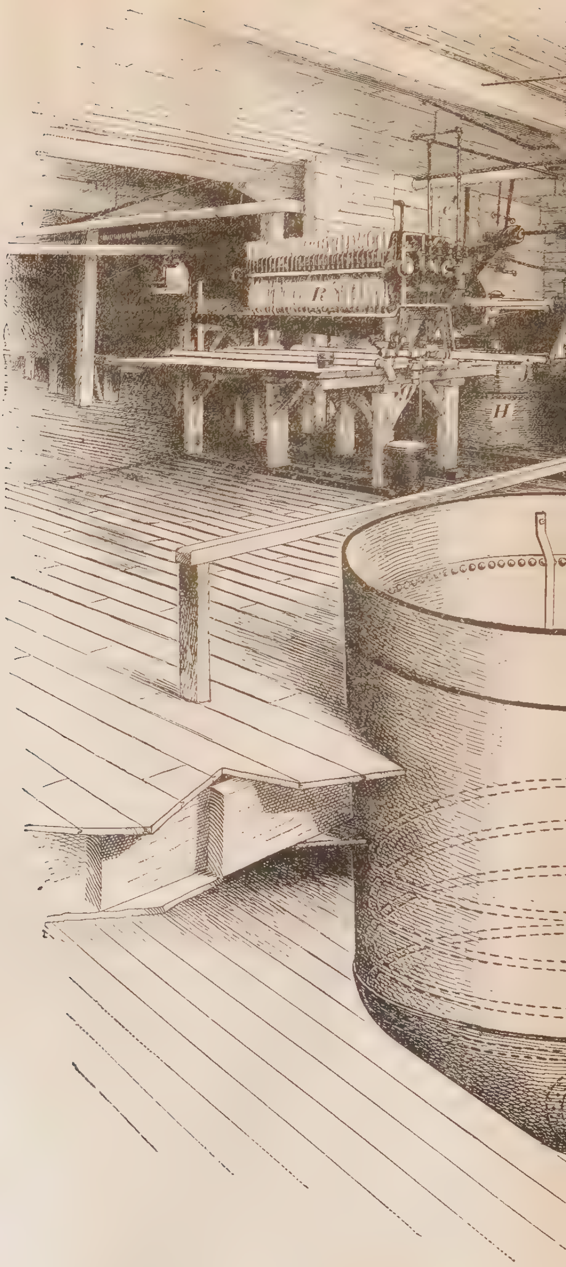
When the tankage has become sufficiently dry, the door *l* is opened, and, with the agitator still operating, the material is discharged by its action in the condition of ground tankage. When ready for the next charge, the door *l* is again sealed, the agitator and the air pump stopped, and the steam to the jacket of the tank shut off.

70. Advantages of New System.—By means of this unique system, the ordinary operations in the usual method of rendering and the separate pressing and drying of the tankage are eliminated together with the expensive tankage presses and driers. The heavy labor and expense always attached to these operations are saved and, in addition, tankage analyzing much higher in ammonia is obtained, owing to the tank water drying with the tankage at a low temperature. An increased yield of fatty material is obtained through the mechanical agitation while cooking, and consequently much less grease or fat is left with the tankage. The low operating expense and the wide adaptability of this system for rendering all classes of material, together with its obvious sanitary features, promise to replace rapidly the ordinary system of rendering offal.

REFINED LARD

71. The lard next in importance in the packing house is refined lard, which is made from the regular steam lard. Although the term refined lard in the past has referred to mixtures of lard with tallow, cottonseed oil, etc., at the present time in the trade it refers exclusively to the pure and refined steam lard. The process of refining is very delicate and outside of the packing house is unknown in all its details.

By referring to Fig. 5, the method of operating may be followed. The iron tank *A* is provided with a cone bottom. The lard in the tank is heated by $\frac{3}{4}$-inch galvanized-iron pipes *c* running around the sides of the tank, the temperature being governed by the steam valve *v*. The blower pipe *x* extends from the blower, or air compressor *Y*, to the bottom of the tank cone, terminating in a circle about 2 feet in diameter. The blower pipe from the top of the tank is 2 inches in diameter.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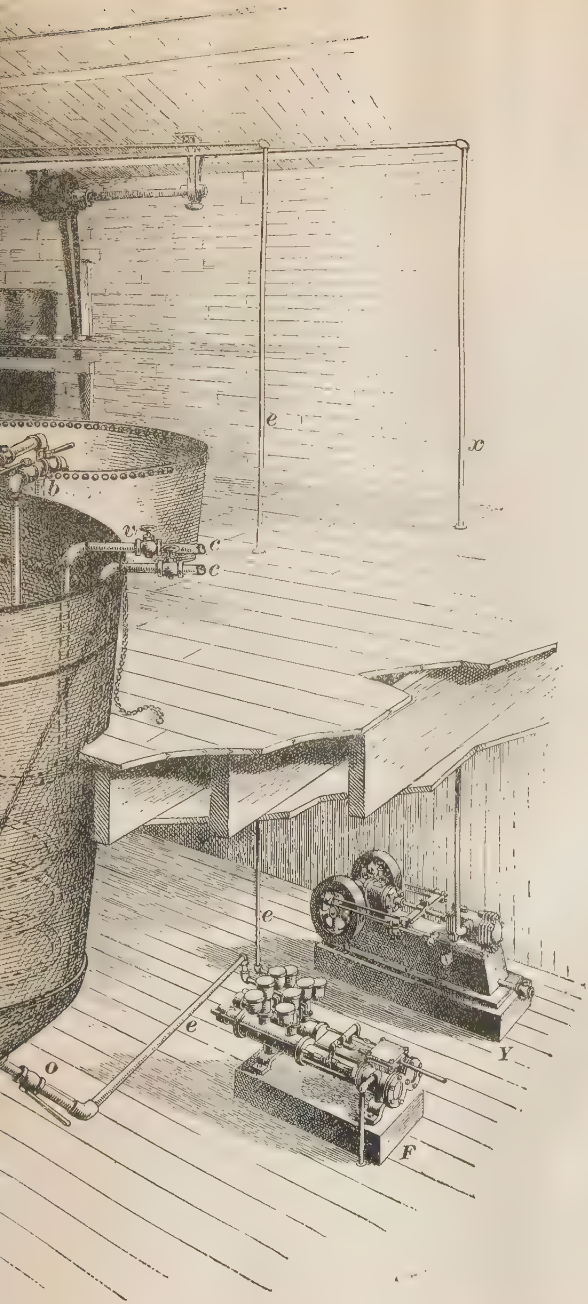
e
x
b
v
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c
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e
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Y
F

The circle of pipe in the bottom of the tank is perforated with $\frac{1}{4}$-inch holes on the top, sides, and capped end for the purpose of distributing the air evenly through the lard, thereby agitating it violently when blowing. The cock *m* serves to remove water and settlings from the lard, and is consequently a very convenient aid in cleaning the tank.

The siphon *d*, held by the chain *k*, is attached to the feed-pipe *e* by a swivel joint inside the tank. The siphon may thus be raised and lowered at will, the lower position representing it when pumping the last portions of material from the bleaching tank. The pump *F* withdraws the lard through the pipe *e* on opening the cock *o* and forces it into the filter press *R*, from which the bleached lard emerges and runs through the 2-inch pipe *j* into the agitator *H* for cooling, chilling, and drawing into the requisite packages.

72. With the apparatus just described, the operation of bleaching the lard is conducted as follows: The lard is pumped into the tank *A* through the pipe *b* until within about 2 feet of the top. As the lard for this purpose is usually taken directly from the rendering tank, is always contains more or less moisture. The lard is heated to 170° F. and the air blower turned on the lard. This is continued for 15 or 20 minutes, when the moisture will be driven off. If the lard contains much moisture, a longer time will be required to drive it off. The practical test applied to ascertain the presence or absence of moisture is to fill an ordinary 4-ounce, oil-sample bottle with the hot lard and allow it to cool for a few minutes. If moisture is present, the lard will become very cloudy and appear thick; if absent, the clear, hot lard will remain clear for a long period. If the hot lard does not cloud in the bottle within 2 or 3 minutes, no moisture is present.

73. Bleaching With Fullers' Earth.—The bleaching medium is now added to the hot lard. This, in packing houses, is always *fullers' earth*. The best temperature for bleaching lard is from 150° to 165° F., depending on the class of material under treatment. The quantity of fullers' earth, or *clay*, varies in the same way, from $\frac{1}{2}$ to 3 per cent. being the usual amount necessary to accomplish the bleach. Lard of good grade will require approximately $1\frac{1}{2}$ per cent. to make it snow white.

The necessary percentage of fullers' earth having been added while the lard is agitated, the pump is started a few minutes afterwards, the fullers' earth in the interval acting on the lard and absorbing the coloring matter. The lard and clay are pumped into the filter press, the first runnings therefrom being returned to the bleaching tank, as they are usually not quite free from the fine fullers' earth. Until the filter-press cloths become filled and coated with the earth, the lard should be returned to the bleaching tank. The three-way cock *g*, Fig. 5, attached to the filter-press trough readily allows of this return by running from it through a movable pipe back to the tank.

The thoroughness of the bleach is determined by holding in a water-white glass, the bleached lard to the light, when the natural yellowish tinge of lard is apparent. When the lard and the glass are of the same color, the bleach is perfected, no tinge of color appearing. The lard is then turned through the pipe *j* into the cooler and agitator *H*, where it is stirred and agitated mechanically until cooled to a thick, creamy consistency, so that it is barely able to flow or be drawn off through cocks or faucets.

74. The longer within limits and the more the bleached lard is agitated, the whiter is its appearance in the drawn-off packages. The agitation continues until all the lard has been withdrawn from the agitator. After all the lard has been pumped from the bleaching tank, the air blower is shut off from the tank and turned on to the filter press, so as to remove the lard held between the plates of the press.

The air pressure forces out the lard, which is added to that already in the agitator. To obtain what lard is held by the fullers' earth on the filter-press cloths, the air is shut off from the press and steam is forced through the whole press. The lard issuing from the filter press under these conditions must not be allowed to mix with good lard; it is usually sent to the grease tank. The steam is continued on the press until all grease matter has been steamed out. The air now replaces the steam and the blowing is continued until the cloths and press are dry. After removing the fullers' earth from the cloths by scraping or shaking, the press is again ready for filtering. The cloths used for filtering are closely woven, strong drilling that is capable of withstanding great pressure. They are usually furnished by the filter-press manufacturers.

75. The most important points in bleaching are the complete absence of all moisture and the proper high temperature —about 165° F. The former condition, however, must prevail or there cannot be a bleach. When fullers' earth is added to moist lards or oils, it immediately assumes a pasty condition, and when pumped with the lard into the filter press, it clogs the filter cloth very quickly with the pasty clay, rendering it absolutely air-tight. When this condition occurs, the whole operation from the blowing of the material must be started again to eliminate the moisture; but at best it is a precarious condition, as too long a contact between the moist clay and lard will impart an earthy taste to the latter, rendering it unsalable.

76. Conditions for Satisfactory Bleaching.—If the temperature of the material is too low, the coloring matter will not be taken from it by the fullers' earth. As a rule, the lower the temperature at which the bleach is carried out, the better will be the resultant product. It is necessary, however, to have a temperature sufficiently high to cause the absorption of the coloring matter present. So far as has been ascertained, the action of fullers' earth in bleaching lard, oils, etc. is purely physical, no chemical reaction between the two taking place. The physical condition of the earth employed in bleaching greatly influences its efficacy. It has been demonstrated that two clays of the same chemical composition may act radically different in effecting a bleach. One would answer every requirement in this direction, while the other gave no indication of bleaching power, thus demonstrating the fact that the chemical composition plays no part in this process. The fullers' earth used in the packing houses is tested in a comparative and practical way, as will be explained further on.

77. Lard Coolers.—Many forms and varieties of coolers, or agitators, for lard are used. The upright open tank in which are revolving arms that work in conjunction with stationary arms on a fixed central shaft, is much used. While this style of cooler will perform the work satisfactorily its chilling capacity is not sufficient for the large packing houses having daily outputs of carloads of refined lard. These agitators have a double shell through which cold water or brine circulates, thereby chilling and agitating the hot lard at the same time.

Another form of chilling apparatus is a long, semicylindrical tank, or box, in which is fitted a revolving, horizontal screw that works in and out of the hot lard alternately, thus exposing it to the air. This cooler sets in ice-cold water which circulates continually. It is adapted only for small manufacturers.

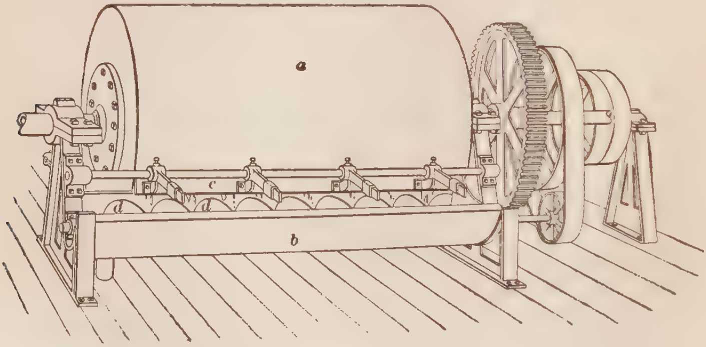

Fig. 6

78. Lard Roll.—The most modern and perhaps the most convenient and economical method of cooling bleached lard is by means of the lard roll, or cooling cylinder, shown in Fig. 6. These cylinders are made in all sizes and are well adapted for quick chilling. They are cast in one piece of cast iron and in the refinery are connected with a circulatory system of brine or ice water, thus keeping the surface of the roll constantly cooled. The lard flows on the top of the cylinder *a*, as it revolves, and by the time the lard reaches the attached scraper *c* it is chilled hard. The cooled lard falls into the trough *b* underneath and is removed therefrom by means of a pump or a spiral conveyer *d* adjacent to an agitator where the lumps are broken up. The lard is then filled into the various packages from this agitator.

79. In some establishments two rolls are used: one, chilled by ice water, receives the hot lard; the other, chilled by refrigerated brine, finishes the chilling. Where large quantities of refined lard are made daily, the use of the lard roll is a necessary requisite for rapid working. These rolls revolve at a speed of about ten revolutions per minute and occupy a floor space of about 12 ft. × 6 ft. The cost of each ranges from $500 upwards.

A recent improvement on the lard roll consists in flowing the material onto the side of the roll, the arrangement of the scraper being such that the lard receives a much longer contact with the chilled surface of the roll.

KETTLE-RENDERED LARD

80. Kettle-rendered lard is an important product of the packing house, as it is the best grade made for the household trade. While this lard was formerly popularly supposed to be made from leaf lard alone, this was never true to any extent. The usual proportions of fat from which kettle-rendered lard is made are, approximately, one-third back fat and two-thirds leaf lard, though these proportions are varied at will.

The lard material is filled into a steam-jacketed kettle which is constructed so as to withstand pressure. The back fat has the rind, or skin, removed and is put in and mixed with the leaf lard. A small amount of fluid rendered lard is put into the kettle before turning on the steam to assist the material in rendering. The material is cooked until the natural moisture of the fats has been eliminated, which requires about 3 hours for a 3,000-pound batch. The hot lard, freed from moisture, is quiet on the surface and free from rising steam bubbles. The steam pressure, as shown by the pressure gauge, should not exceed 10 pounds per square inch, which gives sufficient heat to cook the lard fully in the time just stated.

The cooked lard is allowed to remain in this kettle until all the fine scrap has settled; then it is either drawn directly off through strainers and muslin into packages or run into another settling tank where it remains until wanted for filling into packages. In order to get any lard remaining in it the scrap remaining in the kettle is sent to the steam-lard tanks for further rendering.

Kettle-rendered lard that has been thoroughly cooked, if free from moisture and scrap, will keep for a long period, even under unfavorable circumstances. This lard, if properly made, does not require bleaching; but, if desired, it may be bleached in the usual manner with a small amount of fullers' earth. If the lard becomes burned, or if dark-colored material is used, bleaching is necessary to bring it to the required snowy whiteness.

81. Where large quantities of kettle-rendered lard are made, recourse is had to apparatus similar to that shown in Fig. 7. This apparatus is the same in every way as when making neutral lard, except that the kettle D is steam-jacketed instead of being water-jacketed. The lard material is hashed into the kettle and cooked the required time.

Kettle-rendered lard has a characteristic, distinctive, agreeable smell imparted to it by the method of cooking. Instead of rerendering the cooked scrap, it is often pressed in a lard press, to recover as much lard as possible from it. This course is followed in small establishments where leaf lard is made, such as butcher shops, etc., and where there are no pressure tanks for further rendering. The residue remaining from this pressing is known as *cracklings* from which the fertilizer material *azotine* is made. Cracklings are also used for making poultry food by mixing with ground bone. They always contain a very large percentage of fat.

NEUTRAL LARD

82. Neutral lard differs radically from other lards both in its nature and manufacture and requires apparatus entirely different from that necessary for the production of the other kinds. This lard is made from leaf lard principally, but at times it is profitable to make it from material other than this, which will be described later.

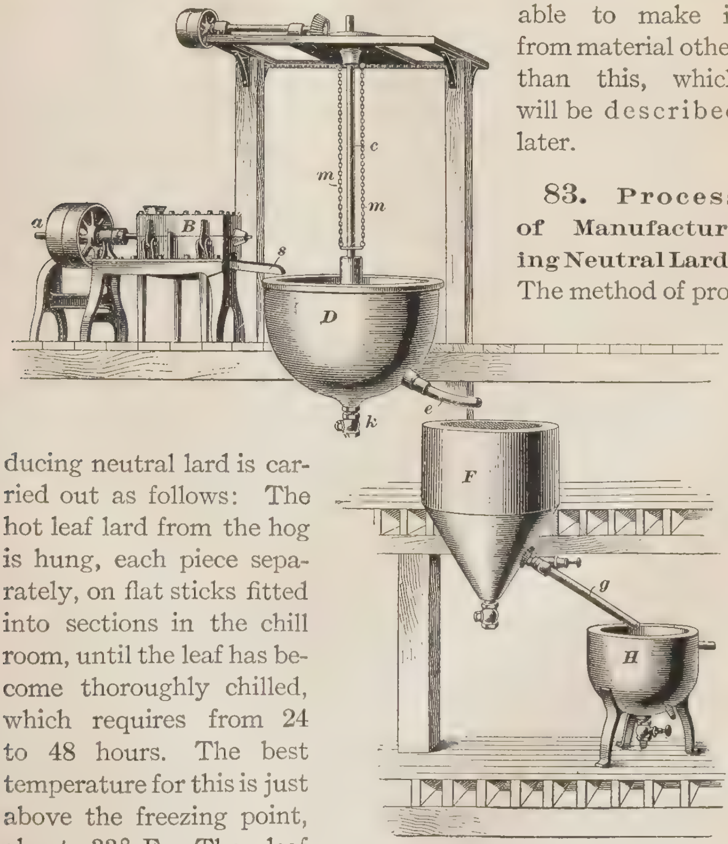

Fig. 7

83. Process of Manufacturing Neutral Lard. The method of producing neutral lard is carried out as follows: The hot leaf lard from the hog is hung, each piece separately, on flat sticks fitted into sections in the chill room, until the leaf has become thoroughly chilled, which requires from 24 to 48 hours. The best temperature for this is just above the freezing point, about 33° F. The leaf lard is then removed to the place of manufacture, which is in a part of the establishment remote from odors that might easily impart a taint to this susceptible material and thus render it useless as neutral lard. The apparatus and its arrangement are shown in Fig. 7.

The lard is introduced into the hasher *B*, which is driven by pulley *a* and revolves at a speed of about 600 revolutions a minute. The hasher is provided with a steam jacket through which live steam is constantly circulating during the period of hashing, or disintegration. The leaf lard is disintegrated into a plastic mass by the action of the revolving knives attached to the shaft of the pulley *a*, and falls through the spout *s* into the melting kettle *D*. This kettle is water-jacketed; that is, the inside steel kettle is surrounded by another shell. In between is water, the temperature of which is regulated by live steam. The two kettles are not closed at the top, so no pressure or temperature above that of boiling water is possible. The plastic lard as it drops into the kettle is constantly stirred by means of the revolving arms fixed to the shaft *c*, which move at the rate of 35 revolutions a minute. The object of this agitation is to prevent the lard from becoming overheated in any one part by lying against the shell of the kettle. The temperature is gradually raised from the starting point to about 120° F., to overcome the chilling of the melting lard caused by the cold lard constantly entering the melting kettle. Only sufficient heat is given the water to keep the temperature rising about 1° in 5 minutes.

84. It will require at least 40 minutes to fill the average kettle, which holds approximately 3,000 pounds of material. The kettle, filled to within 6 inches of the top, will be at a temperature approaching 126° F. The stirring is continued, keeping the temperature steady at this point for 15 minutes, more or less, when all the lard will be melted. The latter operation is materially assisted by breaking any unmelted lumps with the hands. In about 5 minutes more the fine melted scrap will be seen to collect rapidly at the top, when the operation is completed. The steam is tightly shut off, the paddles, or agitator, raised free from the surface of the lard by means of the chains *m*, and the melting mixture allowed to remain at rest for 15 minutes. The temperature by this time will have risen to 130° or 135° F., which temperature must not be exceeded.

The floating fine scrap from the leaf is then removed from the top, the last particles by a gauze skimmer. The removal of scrap is assisted by scattering about 6 or 7 pounds of fine salt over the surface of the lard. This also facilitates the removal of moisture (see Art. 62). The melted lard is now siphoned off by means of the pipe with a swivel joint attached to the side of the kettle; the outside end of this pipe is shown at *e*. The lard as it issues from *e* flows through a fine brass gauze sieve placed over the clarifying kettle *F*, to catch any floating scrap. This kettle is also water-jacketed. The neutral lard is allowed to remain in the clarifying kettle for 2 hours, when it is run through the siphon *g* into the settling kettle *H* from which, after remaining at least 4 hours, it is drawn into the tierces.

85. Packing and Graining.--The lard must be held in the jacketed kettles at a temperature of not more than 130° F. When drawn into the tierces the lard is strained through cheesecloth to catch any possible fine floating scrap. It should be filled in the tierces at this temperature and at once removed to the graining room which is kept at as nearly uniform temperature as possible (between 55° and 60° F.). The 3-inch bungs in the sides of the tierces are removed when the tierces are placed on their sides in order to allow as much lard odor as possible to escape.

After remaining undisturbed for 3 days, the lard will be found to have a grainy consistency. In other words, the stearin and olein of the lard have separated; the larger the grains of stearin are the choicer is the lard. When the lard is in this condition, the tierces may be removed at will; but if disturbed before this separation occurs, the lard will assume the uniform, smooth consistency of ordinary lard and be unsalable. The neutral lard in the required grainy condition is then finished and ready for shipment.

86. Returning to the melting kettle: After all the clear lard has been removed, the fibrous, brownish residue is let out through the pipe and valve *k* into a receptacle below. This residue, consisting of water, scrap, and more or less lard, is sent to the rendering tank in order to obtain as prime steam lard whatever has failed to be drawn into neutral lard. An analysis of the scrap removed from the top of the kettle was as follows:

	PER CENT.
Moisture	3.70
Fiber	28.91
Lard	67.39
Total	100.00

87. Grades and Properties of Neutral Lard.—There are no chemical requirements for neutral lard. The only trade requirements are purely physical, consisting of condition, taste, and complete absence of any odor whatever. The taste must be bland and more or less milk-like. The condition, as before mentioned, must be a sharp and decided separation of the stearin from the olein. The color of neutral lard is always snow-white. The lard made from the leaf is known as choice, No. 1, or extra neutral.

88. When the price is suitable and favorable conditions prevail, a neutral lard, known as No. 2 neutral, may be made from back fat and fresh ham fat. This material is freed from the accompanying rind, or skin, and treated in the same manner as the leaf lard with the exception of temperature. This material containing a much larger proportion of stearin must be melted at a higher temperature to obtain a fair yield of neutral lard. The melting of this class of material takes place at a temperature of 136° F., the temperature rising to 142° F. —the limit to which it should be carried. The further treatment of settling, etc. is the same as that described for regular neutral lard.

89. Uses of Neutral Lards.—The principal use of neutral lard is for the making of oleomargarine, or butterine. As this lard is not fully cooked, but melted, its keeping qualities are very limited; hence, no attempts are made to cater to household trade. Neutral lard must always be kept in cold storage, or it will quickly become rancid. The yield that may be obtained from average leaf lard is about 92 per cent. of neutral lard; from the residue cooked under pressure a further percentage of steam lard is obtained. The approximate cost of an apparatus to make neutral lard is about $1,500, more or less, and, together with that shown in Fig. 7, it consists of a few minor utensils such as trucks, strainers, etc. Neutral lard always brings a higher price than any other.

STIFFENED LARDS

90. In making lard for summer sale or for warm climates it must be made of such consistency that it will remain in a more or less solid condition. This does not in any way apply to prime steam or neutral lards but only to kettle-rendered lard and refined lard.

91. Methods of Stiffening Lards.—The most rational method of stiffening lard consists in selecting the stock before rendering, by using for steam lard or other purposes the softer parts of the fats such as feet, and using only those parts which are naturally firm, on account of the greater amount of stearin contained in them, for the refined or kettle-rendered lard. While this method is practiced largely in establishments where such selection may easily be made, smaller packing houses are obliged to use another method. This consists in adding to the lard an amount of lard stearin not exceeding 5 per cent. Lard stearin added to lard to this extent is not an adulteration, as it is a natural constituent of the lard itself.

92. The following are excerpts from rules regulating transactions in lard among members of the New York Produce Exchange, adopted at a meeting of the Lard Trade, held March 27, 1890, and amended July 1, 1921.

Prime Steam Lard Standard

Rule 2.—Sec. A. Standard prime steam lard shall be solely the product of the trimmings and the fat part of the hog rendered in tanks by the direct application of steam and without subsequent change in the grain or character by the use of agitators or other machinery, except as such change may unavoidably come from the transportation. It must have proper color, flavor, dryness, and soundness for keeping, and no material which has been salted must be included. All lard must be rendered in conformity with the rules and regulations of the United States Department of Agriculture. The name and location of the renderer, the date of packing, and the grade of lard, shall be plainly branded on each package at the time of packing.

SEC. B. Prime steam lard of superior quality as to color, flavor, and body may be inspected as "Prime Steam Lard, Choice Quality," and shall be deliverable on contracts for "Prime Steam Lard."

REGULAR TRADES

SEC. B. In the absence of any special agreement, all lard sold on the spot or to arrive shall be understood to be the Standard quality of "Prime Steam Lard," and which is generally termed in future trades Contract Lard.

PACKING AND COOPERAGE

RULE 4.—SEC. A. Prime steam lard made between October 1 of any year and December 31 of the year following only shall be considered "Standard," and a good delivery on contracts maturing during that time.

All lard to be classed as "Standard" shall be packed in new cooperage and made of well-seasoned white or burr oak free from objectionable sap.

SEC. B. The dimensions of tierces shall be about as follows: 32 inches long with 21-inch head, or 33 inches long with 20½-inch head; staves to be chamfered at the head; staves ¾ of an inch thick, head 1 inch thick in center and ⅜ at bevel; hoops hickory or white oak or other good wood, to be hooped not less than 11-16.

Iron bound tierces shall be classed as Standard if made in compliance with the requirements of this rule as to heading and staves and hooped with not less than three (3) good hoops on each end, head hoops 1¾-inch 18-gauge, quarter hoop 1½-inch 19-gauge, bilge hoops 1¾-inch 19-gauge.

STANDARD WEIGHT OF TIERCES AND TANK

RULE 5.—Tierces shall contain not less than 340 pounds lard nor more than 410 pounds. The "Standard" net weight of tierces of lard shall be 375 pounds, and any variation therefrom, when delivered on future contracts, shall be settled for at the settling price of the 11 o'clock call on the day of delivery. The number of packages contracted for must be delivered, and all tierces must have weights and tares marked thereon. Tanks, in the absence of any special agreement, shall be understood to contain 60,000 pounds net. Any variation therefrom exceeding five per cent. (5 per cent.) either buyer or seller may have the right of settling at the market price on date of delivery.

INSPECTORS AND WEIGHERS

RULE 6.—SEC. A. All inspectors and weighers of lard for delivery on sale or contract under the rules of the Exchange must be members thereof, and licensed by the Board of Managers, and must obligate themselves not to buy or sell on their own account any article they are licensed to inspect or weigh.

No certificate of lard, tallow, grease or animal product of any description shall be considered proper unless worded in harmony with the rules and regulations of the U. S. Department of Agriculture. And all licensed inspectors' certificates shall state whether, upon evidence at hand, the said products came from a "U. S. Inspected Establishment" and "Uninspected Establishment" or "Origin not stated." Care should be taken not in any way to facilitate the passing into interstate or foreign commerce of edible meat food products from establishments not under U. S. Inspection. * * *

Weight, Inspection, and Tares

Rule 7.—Sec. A. The seller shall have the right to designate the weigher, but buyers shall have the right to designate an Inspector; either shall have the right to appeal to the Committee, as the case may be, whose decision shall be final and binding.

Sec. B. To determine the tare on lard, four (4) per cent. of the number of packages shall be tested at the expense of the seller. The tare shall be ascertained by scraping the lard from the packages, and not by removal by dry heat or steam. The empty packages shall then be weighed and the lard replaced, and the weight of the refilled packages shall be the gross weight.

Sec. C. In testing for weight and tares, packages which are evidently mismarked shall be excluded from the average.

Sec. D. All appeals from weight, inspection, and tares must be settled at the place of delivery unless otherwise agreed upon.

Sec. E. Seller must give buyer timely notice to attend to inspection, weight, and tares. If buyer fails to attend to the same within a reasonable time, it shall be the duty of any two members of the Committee on Lard, upon such notice and failure, without fees, to appoint an inspector to sample the lard for delivery on that notice, and his inspection shall be final on that delivery.

Lard Calls

Rule 9.—Sec. A. There shall be, if required by the trade, two public calls of lard each day, except Saturdays, when there shall be only one call. The Committee on Lard shall fix the time when such calls shall be held. These calls shall be conducted by a person appointed by the Board of Managers or in his absence by a person to be selected by the majority of members present.

At the last call prime steam lard in second-hand hardwood tierces, prompt delivery, will be called, if required, weighing and inspection to be paid by the buyer.

The months shall be called in their respective order. No offer to buy or sell shall be entertained at a less difference than 1 cent per hundred pounds (100 pounds).

The first offer to buy or sell at a price shall be accepted before subsequent offers at same figures may be placed. Subsequent offers to sell at a lower or buy at a higher price shall vacate prior offers to sell at higher or buy at lower prices. A transaction shall vacate all previous bids and offers, except as provided in Section B for transactions in stated quantities.

Sec. B. Unless otherwise specified, all offers to buy or sell shall be understood to be in lots of 100 tierces or 37,500 pounds. Offers to buy or sell in larger quantities than above specified shall be in multiples thereof, and offers to buy or sell any part of the amount which may be named shall take precedence of stated quantities; but if stated quantities are offered or bid for, transactions in smaller parcels shall not vacate such offers to buy or sell, but the same shall be governed by the conditions of Section A of this rule. * * * *

Rule 10. Either party to a contract, prior to or upon signing the same, shall have the right to call an original margin of $1 per tierce on lard, and a further margin may be called from time to time to the extent of any variation in the market value from the contract price.

Where no original margin has been deposited, calls may be made from time to time to the extent of fifteen (15) cents per one hundred pounds (100 pounds) above or below the market price of lard. * * *

METHOD AND FORM OF CONTRACTS

Rule 11. The seller and buyer shall in every case make out the confirmation slips on day of transaction, as per the following form:

CONFIRMATION SLIP

New York........................19....

I (or we) hereby confirm sales (or purchases) made by me (or us) today, under the rules of the New York Produce Exchange and either party may at any time demand a contract in place hereof as provided by the by-laws in lieu of this slip, as follows:

To, (or from)........................

Amount	Delivery	Kind of Property	Price

(Signed)..................

The following shall be the form of contract for lard sold for future delivery, which either party may at any time demand in lieu of confirmation slip:

LARD CONTRACT

New York........................19....

In consideration of one dollar in hand paid, the receipt of which is hereby acknowledged, we have this day sold to (or bought from)..............

One Hundred Tierces of Prime Steam Lard, at......cents per lb., deliverable at seller's (or buyer's) option. This contract is made in view of, and in all respects subject to, the By-Laws and Rules established by the New York Produce Exchange in force at this date.

Signature....................

APPEAL ON CONSTRUCTION OF RULES

RULE 22.—SEC. A. Any party feeling himself aggrieved by the decision of the Committee on Lard, in the interpretation of these rules, shall have the right to appeal to the Board of Managers of the Produce Exchange.

SEC. B. No change shall be made in the rules by the Committee on Lard before submitting the same to a meeting of the Lard Trade, at which ten shall form a quorum.

INSPECTION RATES

NOTE.—At a meeting of the Lard Trade, held May 16th, 1892, the following were fixed as the minimum charges on lard handled in New York after this date:

Weighing, 4 cents per tierce.
Inspection and marking, 4 cents per tierce.
Stripping, 50 cents per tierce.
Nailing, 4 cents per tierce.

NOTE.—The following addition was made to the Inspection Rates at a meeting of the Lard Trade held July 6, 1897:

Inspection and weighing $5 per Tank of 42,500 pounds.

EDIBLE COMPOUNDS

93. Compounds or Shortenings.—In addition to lard several other classes of fats and fat mixtures have come into general use as shortenings. Prior to the enactment of the Food and Drugs Act of 1906, there were put on the market fat mixtures as lard compounds or compound lards, which, however, contained no lard whatever. They were composed of oleo stearin, edible tallow, and cottonseed and other oils in varying proportions. Under the present regulations, however, to be classed as a lard compound, there must be present in the mixture a quantity of lard greater than the sum of the other ingredients. At present, the manufacture of these lard compounds, by the large packers at least, has been entirely supplanted by the preparation of the fat mixtures described here.

94. Ingredients Used in the Manufacture of Edible, or Cooking, Compounds.—The compounds now marketed consist chiefly of cottonseed oil mixed with varying proportions of oleo or vegetable stearins. The proportions of the different ingredients vary according to the season of the year, the locality in which it is to be sold, and the market price of the different components. In winter, these compounds are largely manufactured to contain approximately 80 per cent. cottonseed oil and 20 per cent. stearin. During the summer months, the compounds contain 75 per cent. of the oil and 25 per cent. stearin. These proportions may be varied at will or according to circumstances. For warm climates a summer formula must be used for making the compound, while for cold climates the winter formula may be used at all times.

95. The cottonseed oil used in these compounds must be highly refined, sweet in flavor, odorless, and be not darker in color than 2.5 red, and 20 yellow, on the Lovibond Tintometer scale.

The oleo stearin is pressed from the highest grade of beef fat known as No. 1 oleo stock. It should be white in color, sweet and nearly odorless, with a titer of 50° to 51½° C., and the fatty acid never exceeding .40 per cent.

The vegetable stearin is a highly refined, hydrogenated or hardened vegetable oil, usually cottonseed oil. In appearance it closely resembles oleo stearin, but is much harder, as the titer runs from 58° to 62° C. It may be noted that the vegetable stearins are simply liquid fats or oils which have been caused to take up or absorb hydrogen whereby they are converted into solids.

96. The cottonseed oil as received from the refiner is much too dark in color to enter into the manufacture of these compounds. For this reason it is customary to bleach the oils with mixtures of fullers' earth and charcoal. In bleaching the oil is pumped into large, open tanks holding as much as 30,000 pounds. Large propeller-shaped agitators keep the oil constantly in motion, and enclosed steam coils raise the temperature to 230° F., with the subsequent elimination of practically all of the moisture. If any moisture remains it will be absorbed by the earth, forming a paste, with resulting failure to effect a bleach. When the moisture is expelled the proper amounts of earth and charcoal are added and agitation continued until a sample pumped through the filter press shows that the desired bleach has been obtained. The stearin is then added and when melted the whole is pumped through the press into the receiving tanks. After deodorizing the compound is subjected to certain processes which in some plants are as follows: The melted compound flows onto a lard roll, or cooling cylinder, as illustrated in Fig. 6. As the cylinder revolves the chilled compound is scraped off into a trough called the *picker-pan* where revolving paddles beat air into it. A spiral conveyer delivers it to a pump by which it is forced into the desired containers.

PACKING-HOUSE INDUSTRIES

(PART 2)

VARIOUS ANIMAL PRODUCTS AND THEIR DISPOSITION—(Continued)

THE FILTER PRESS IN THE PACKING HOUSE

1. The use of the filter press in the packing house is, comparatively speaking, of recent date. This press is used for many operations and for the preparation of many packing-house products, among them being lard, oils, tallows, glues, and, at times, beef extract. The principal advantages of a filter press are: (1) The largest possible filtering surface in the smallest possible space; (2) the facility of forcing the material through the filtering cloth by the most suitable pressure which varies from a slight pressure to a working pressure of 1,000 pounds to the square inch; (3) the ease with which the filter press may be handled; and (4) the rapidity of filtering large quantities of material at a very nominal cost.

2. Construction of Filter Press.—Filter presses are made with both square and round plates and are of all size and capacities. The square press, while not so convenient to handle as the round one, will hold more stock and on this account is more desirable for packing-house use. The series of round or square plates of cast iron, or other suitable material is hung on the press rods. The plates

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have concave faces on each side, the rim, or outer edge, being finished smooth and sufficiently wide to avoid unnecessary wear on the filter cloths and the forming of tight joints. The concave surfaces of the plates are provided with grooves by means of which the filtered material passes off. A hole in the center of each plate affords a channel through which the material to be filtered is forced when the press is charged.

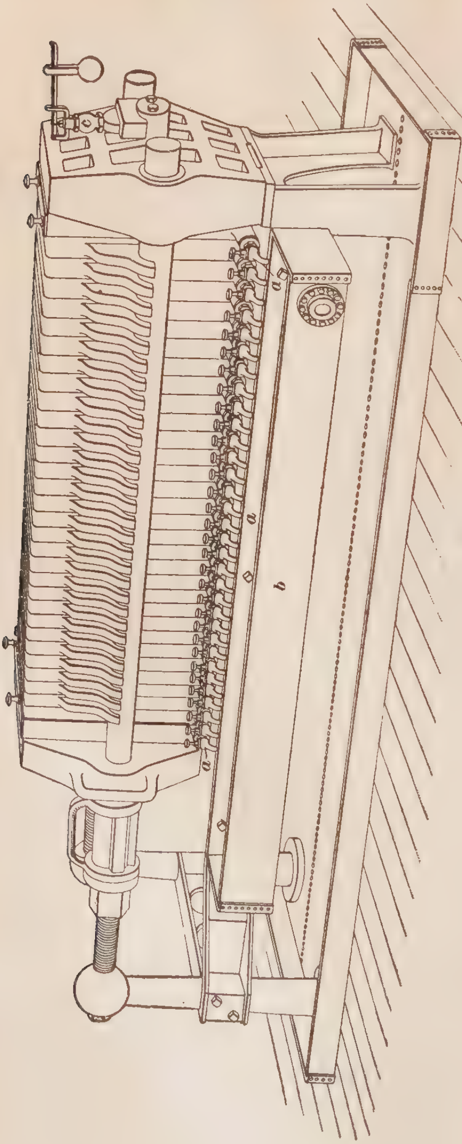

Fig. 1

3. Fig. 1 illustrates a press of 24-inch square plates that is capable of producing an inch cake (between the plates) and has a working pressure of 150 pounds per square inch. One chamber of this press will hold 484 cubic inches of material to be filtered. A press like this will filter from 7,000 to 8,000 pounds of lard per hour.

4. Fig. 2 illustrates a single plate of a filter press, a view of the perforated metal front and also of the center clamp being shown. This plate has an outlet cock attached for drawing off the filtered material. The plates are covered with the filter cloths which are placed on each side, and are fastened at the center by means of adjustable screw nuts. These plates are also held in place by adjustable fastenings, as shown. When all the plates are covered with the cloths they are forced together by a follower which is actuated by a screw, and are tightened by a long lever; or, in some cases, depending on the form of press, by a lever wheel, or by a hand-wheel ratchet lever. Different presses are provided with different means of closing.

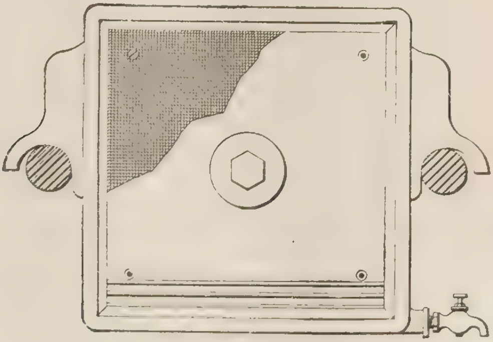

Fig. 2

5. A recent improvement on filter-press plates is shown in Fig. 3. This improvement consists in having a delivery channel at the bottom of the plate, as shown. This channel, it is claimed, increases the capacity of the filter plate 25 per cent. These plates are made both round and square and with a corrugated or a pyramidal surface, the latter being shown in the figure.

6. Filter-Press Cloth.—An important condition in the attainment of satisfactory results consists in the filter-press cloths being of good material. The fabric must be pliable yet closely woven, so that while giving a clear filtrate it will be sufficiently strong to withstand the heavy pressure exerted by the pump when forcing the oil or the lard through the press. Either heavy drilling or cotton duck is suitable for packing-house use.

7. Operation of the Filter Press.—When the pump is running the material to be filtered is forced through the center channel, filling all the chambers in the plates. The pressure forces the liquid through the cloths to the surface of the plates and it passes down the grooves, or channels, on the face, through the outlets *a*, Fig. 1, in the plates, and then into the receptacle, or trough, *b* beneath. The impurities and bleaching material, such as fullers' earth, are retained by the cloths.

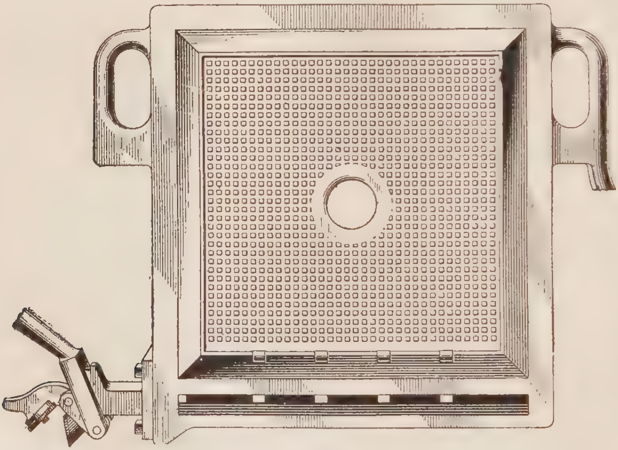

Fig. 3

The filter press is provided with a safety valve, or outlet, *c* through which when undue pressure is exerted on the press by the pump the material may find an outlet. This safety valve prevents the press or the cloths from bursting, which is liable to occur when wet or moist clay is mixed with lard, tallow, or similar material and efforts are made to force this mixture through the filter press. The valve may be set to operate at any desired pressure, but for packing-house work, 150 pounds per square inch is sufficient. Some filter presses are built with a top feed; the valves being so arranged that only a part or all of the press may be used at one time.

It is sometimes desirable to filter quantities so small as not to fill all the plates of the press. In this case a blank, or dummy, plate, which is a solid plate without a center channel, is used to cut off any portion of the press. To use the dummy plate, it is inserted between any two plates where the flow is to be cut off. For example, if only five chambers of the press are wanted for use, the dummy plate is inserted between the fifth and sixth plates and the press screwed tight. In this manner, a perfect working press of five chambers is made. The dummy plate is very convenient and should accompany every filter press.

TALLOWS, GREASES, AND OILS

KINDS OF TALLOW

8. Tallow is the rendered fat of cattle, calves, and sheep, being for the most part inedible and largely consumed by the soap-making industry. The small portion of the tallow which is edible is consumed in the manufacture of oleomargarine and cooking compounds. Goats are occasionally slaughtered in the packing houses of the United States but their number at the present time is of no industrial importance (see *Packing-House Industries*, Part 1), although their fat may also be rendered into tallow.

The tallows rendered in the packing house include edible, extra-prime, No. 1, and No. 2, the three latter being inedible. Sometimes other tallows are produced having special designations, but the ones mentioned are the ones usually produced.

9. Edible Tallow.—The highest grade of tallow is that known as edible tallow, which, as the name implies, is used in food compounds or as a cooking fat. It is made of high-grade beef fats that have been subjected to thorough washing in ice water so as to remove the blood and other impurities before placing them in the tank for rendering. The fat undergoes another washing in the tank, this time, however, in heated water. The tank is then closed and the fat is rendered under pressure. Fats from which edible tallow is made are of a grade suitable for the making of oleo oil and stearin but are of a troublesome, small size.

The material is carefully rendered in the usual manner, especial care being taken, however, not to subject it to too high a temperature or to cook it too long. A pressure of 25 pounds of steam per square inch for 8 hours will give good results in making a high-grade material. As an advanced price over the regular prime tallow is always obtained, the extra preparation and care is thus repaid. This tallow is now extensively made, as the demand for it is very great, being used for the manufacture of lard and edible cooking compounds. The hardness, or titer, of this product is not of such moment as the amount of free fatty acid which must not exceed ½ per cent.

10. Extra-Prime Tallow.—Extra-prime tallow is made principally from straight-rendered fats which are not quite good enough for edible purposes. All fatty materials from which this tallow as well as the No. 1 and No. 2 tallows are prepared, is carefully graded and washed before being sent to the tank house. This is done in circular washers designed for the purpose, after which the material is again sorted and put into the tank. The grading of the fatty stock before rendering assists in maintaining a uniform product while the washing serves to remove impurities that would cause the tallow to be much darker in color. The material is cooked in the tank, a pressure of 30 pounds of steam per square inch for 5 hours being usually sufficient. It is for the most part prepared from dirty fats from the oleo and other departments handling edible products, condemned and dead carcasses other than hog, bruised and dirty fats from the killing floor and other fats of light color and low fatty acid. The color of this material when drawn into barrels and chilled must be a clear yellow and not grayish or of any decided shade; if white and clear, it is more desirable. The fatty acids should not be above 2.5 per cent. and the titer should be 43.5 to 44.5°. It is used in the manufacture of tallow oils and soaps.

11. No. 1 Tallow.—The No. 1 grade of tallow differs from the preceding only in the nature of the material from which it is rendered. It is darker in color and has more or less lean tissue adhering to it from which it is separated by the steam pressure in the rendering tanks. It is manufactured largely from waste guts and intestines and trimmings from these when used for edible purposes. Included also are trimmings from the hide cellar, meat scraps from the canning room, all condemned guts from beef, sheep, and calves, and certain catch-basin skimmings. The stock for No. 1 tallow is subjected to soaking and washing before rendering, as, in common with all material of this nature, the more washing it receives the better will be the resulting product. As this material is nearly always accompanied by more or less filth, slime, and dirt, vigorous washing is frequently necessary in order to produce a tallow with the characteristics demanded in this grade.

The same cooking that is given to the extra-prime tallow is given to this. While the color and cleanliness of the product are of importance, the sale price is in reality based on the free fatty acid, titer, and the M. I. U. These three letters are the trade name or abbreviation for moisture, impurities, and unsaponifiable, the latter being the amount of the material that cannot be converted into soap. The free fatty acid is usually under 6 per cent. and the titer 43.0 to 44.0° C., while the M. I. U. will rarely exceed 1.5 per cent. If the fatty acid or M. I. U. exceed the figure given or if the titer is less than the above, a certain deduction in the sale price of the tallow is customary. As these values are of such importance both to producer and consumer, a detailed method for their determination will be given later.

12. No. 2 Tallow.—The grade known as No. 2 Tallow is made of all tallow-yielding material not of a grade sufficiently high to have entered into the classes mentioned before. It is usually composed principally of catch-basin skimmings and rendering from offal and low-grade material such as the pressings of beef tankage and fertilizer material. The poor character of the material entering into this tallow makes no special standards or requirements for this grade possible. Each lot, therefore, is sold on its own merits, as regards the features just stated, and also the free fatty acids and the titer. It is used largely in the manufacture of low-grade soaps with its accompanying by-product, glycerine, and for distilling into oleic and stearic acids. When the percentage of free fatty acids is excessive, this tallow cannot be used profitably for the manufacture of soap and glycerine. The color is always dark and varies widely from yellowish-green to brown. The free fatty acid may vary from 15 to 30 per cent. or even higher. The titer is usually from 41 to 43° C.

13. Cake Tallow.—The name cake tallow is derived from the shape of the finished product. This tallow is of good grade and has a titer of at least 44° C. The form, or shape, of the cakes is a matter of individual judgment, the most common form, however, being a cake about 3 inches thick and 6 inches square. The cakes usually weigh 5 pounds each, and they are generally packed in boxes having a capacity of twenty cakes.

Cake tallow is generally white in color, but need not be, if the requirements as to hardness and freedom from impurities are acceptable. The harder the tallow the better it suits the consumer. This tallow is made by running the warm and molten tallow into sheet-iron molds of the required dimensions and chilling quickly by any convenient means, without allowing the material to grain by separating into oil and stearin. The cakes when thoroughly chilled may be easily knocked from the pans and immediately packed.

This tallow costs about $\frac{1}{4}$ cent a pound more to make than tierce tallow, but the selling price greatly exceeds this extra cost. It is a very profitable article of manufacture. Cake tallow finds use in the lumber regions, both for lubricating machinery and for lubricating the runways for logs. In the lumber industry, owing to its general utility, this tallow has not yet been replaced by oils. When tallow suitable in all respects for cake tallow, except in hardness, is wanted for this purpose, an addition of a few per cent. of tallow stearin will enable it to fill the requirements.

14. **Mutton Tallow.**—Where large numbers of sheep are slaughtered the tallow from the offal is cooked by itself and produces a white, hard tallow known as mutton tallow. The usual method is to cook the heads and other material other than lungs, livers, and feet, in an open vat with live steam for 10 to 12 hours. After a period of settling the resulting tallow is collected, freed from water, and tierced. The offal from the intestines, feet, etc., produces a dark-colored material, which is tanked with the usual material for No. 2 tallow.

The tankage remaining from the open cooking in the vats is again cooked under pressure with the ordinary No. 1 tallow stock, materially contributing if in any quantity, to raising the titer of that grade. Mutton tallow has a titer of 44° to 48° C., the latter when made of the caul and kidney fat. This tallow is very useful for making cake tallow.

15. **Yield of Tallow.**—The yield of tallow from fat is extremely variable, depending very much on the material from which it is made. When the total fat of a bullock other than that left with the dressed beef is tanked, the yield approaches from 74 to 78 per cent. of tallow. This includes the caul fat and other parts generally selected for oleo oil and stearin. This yield can be increased to 80 per cent. by careful and thorough pressing of the cooked tankage after rendering.

When the general run of fat for ordinary tallow is tanked and the highest grades removed, the yield approximates from 68 to 78 per cent. of the material cooked. The amount of tallow obtained in all cases depends on the quality and fatness of the animals slaughtered, and on the care taken in rendering.

The yield of tallow from bones, as with other things, is exceedingly variable. This tallow is in reality a bone oil. It is a soft, yellowish-white material that may be and at times is utilized in making the lower grades of oleo oil. The tallow obtained from the heads of cattle is the same material as that derived from the other bones. It has a titer of about 42° to 42.5° C.

Kidney fat when tanked by itself may be made to yield from 90 to 95 per cent., the latter in exceptional cases. Caul fat and ruffle fat when cooked under pressure will yield from 78 to 84 per cent., depending on the quality of the cattle from which these fats are taken.

GREASES

16. Classification.—Greases are considered as inedible fats intermediate in hardness between tallows, which are hard fats, and oils, which are liquid fats. They are derived exclusively from the hog, as there is no advantage in putting the fat from other animals into this class. Being too soft for use in the manufacture of soaps, the greases serve the sole purpose of pressing into lard oils and stearin. It is common practice to produce four grades of greases depending on the color and free-fatty-acid content, although this number is often modified in the different establishments. In the order of their value, these grades are known to the trade as, A white, B white, yellow, and brown grease.

17. Grade A White Grease.—The first grade of inedible fat from the hog is known as Grade A White Grease, being practically white in color and having a fatty-acid content under 2 per cent. It is made from material that would ordinarily produce lard had it not been contaminated during the process of manufacture. It is very similar to lard in appearance, odor, and color, and is a lard except in name and purity. All hogs condemned before or at slaughter and condemned-pork material furnish the source of this grease, together with other material of high grade. The stearin from it is not sold as lard stearin, but must be branded *grease stearin*.

18. Grade B White Grease.—Grade B White Grease is very similar to the preceding, being somewhat darker in color and higher in free fatty acid. This figure may at times reach 10 per cent. This grease is obtained from material that is not dark in color or discolored, the resulting grease being of a light-fawn or buff color, and having a strong, more or less rank, odor. Boiled-out ham grease, sausage-room grease, gut and trimming-room fats furnish a plentiful source of fats for this grade of grease.

19. Yellow Grease.—The grade known as yellow grease is made of rather dark-colored material or good-grade material intermixed with a small quantity of poor material. For example, grease from ham boiling, which by itself is B white, when mixed with grease from the livers, lungs, etc., becomes yellow grease. In small establishments where all grease material is cooked together, the resultant product is yellow grease. This grease has a strong, rather nauseating odor, and the color, as the name indicates, is yellowish. On pressing, yellow grease yields No. 1 lard oil and yellow-grease stearin. If light in color, the yellow grease may yield an extra No. 1 lard oil.

20. Brown Grease.—The grade known as brown grease is made of all refuse grease-yielding material in the packing house. The pressed-out grease from tankage is used for this purpose. The dark-colored, greenish-black grease yielded from livers, lungs, and floor scrapings is brown grease. It is also consumed in a small way in the manufacture of cheap soaps, axle grease, etc. When this material is pressed, No. 2 lard oil and brown-grease stearin are obtained. Brown grease from hog material corresponds with No. 2 tallow from beef material.

21. Methods of Obtaining Grease.—Greases are obtained from the fatty material in the same way as lard. Greases of good grade are washed in the tank in the same way as lard material, but with the lower grades such as yellow and brown, no washing is performed. In fact, it would be a waste of time and labor to wash the cheaper grades. Even if the grease were made a shade or two lighter than usual, it would command no higher price on account of this single characteristic. The tankage from grease material is treated as the regular lard tankage.

OILS

22. Kinds.—Oils is the collective name given to the various grades of oleo oil, lard oil, tallow oil, and neatsfoot oil. By *oil* is meant that portion of a grease which when separated from the stearin of the grease remains a liquid at ordinary temperatures. In other words, a stock, or tallow, or grease, is only a mixture composed of a soft and a hard portion. The hard portion is known as stearin and the soft portion as oil. The two portions are separated from each other by means of a press. The particular manner in which the various oils and stearins are handled will be described later.

The grade of oil depends upon the grade of beef stock, grease, tallow or neatsfoot stock from which it is derived. The grade of stock in turn depends largely on two factors—the free-fatty-acid content and the color—the better grade being that with the lowest free-fatty-acid content and the lightest color.

Oils, tallows, and greases are all chemical combinations of glycerine with fatty acids. Whether the material is a grease or a tallow depends on the nature and varying proportions of the fatty acids which are combined with the glycerine in that particular fat. Under certain conditions, such as the presence of moisture and impurities, subjection to high temperatures, poor and improper handling, greases and tallows split up into glycerine and free fatty acids. These same conditions also usually cause a darkening of the color. In general, this increase in fatty acid and darkening in color is objectionable, although not in all cases. The particular oils will be considered later.

23. Oleo Oil.—The third item of value obtained from the bullock after the dressed beef and the hide, is the fat, from which is manufactured the edible oleo oil and the oleo stearin. Prior to 1871, practically none of the fat from the bullock was used for food but almost exclusively for soap and other manufacturing purposes. About that time it came into use in the preparation of butter substitutes, which increased in popularity until the trade has reached its present tremendous proportions. The manufacture of oleo oil forms a most profitable outlet for the large part of the fat of the bullock that otherwise would be rendered into ordinary tallow. In the manufacture of oleo oil scrupulous cleanliness is a most important consideration, as without it no first-class product can be obtained, even if the best material is used. While cleanliness is important, necessary, and even obligatory everywhere in the packing house and with all products, oleo oil is probably the most sensitive to deterioration on account of unclean surroundings.

Depending on conditions at the time, it is customary to manufacture as many as four grades of oleo oils. The No. 1, or highest, grade is of neutral flavor, light in color, nearly odorless, and has a melting point of from 85 to 90° F. The fatty acid is under 0.40 per cent. It is usually made from the ruffle fat, caul fat, gut-end fat and all other carefully selected fats of neutral flavor. The No. 2 grade differs from the preceding wholly in the more pronounced flavor of the fats entering into its manufacture. The color is slightly deeper and the flavor noticeable. It is made principally from kidney and cod fat, and machine and chip fat. The No. 3 oil is much deeper in color and the melting point may be as high as 95° F. It is not as sweet as the other grades and it may have a decidedly cooked flavor. It is made largely from bone oil and kettle washings. A fourth, or yellow, grade of oleo oil is also manufactured. It is similar in quality to the No. 1 oil, but being manufactured from grass-fed cattle, is much deeper yellow in color. It enters into the preparation of the oleomargarine.

24. Manufacture of Oleo Oil.—The fat after removal from the animal is conducted through galvanized-iron chutes into a washing vat located in the oleo-oil department. This department is usually on the floor immediately below the one on which the animals are slaughtered. All dirt and blood is removed in this water which is usually at a temperature of 60 to 70° F. The cutting machine reduces the fat to small pieces when it is again plunged in a vat of water kept at 40° F. The object of putting the fat into colder water gradually is to avoid hard chilling on the surface of the heavier pieces. If this took place the animal heat would be prevented from escaping through this solid part of the fat. The heat retained in the interior of the fat would very quickly cause it to become sour and unfit for the best and edible grades of oil. The fat remains in this second vat until the animal heat has been removed, and then it goes into a third vat usually chilled with ice. It is customary to grade or sort the fat following the first washing and preceding the slicing or cutting. These successive transfers of the fat require about 10 to 12 hours, it being kept in the iced water until about an hour before it is wanted for hashing, which precedes the melting of the fat into oil. This chilling further hardens the fibre surrounding the fat cells so that the fat is more thoroughly separated from the fibre in the melting tank when aided by the hashing. After passing through this hasher, which is merely a large, steam-jacketed sausage machine, the fat is ready for the melting tanks.

The chilled beef fat is placed in the hasher and disintegrated the same as leaf lard. The same apparatus may be, and often is, employed for the manufacture of both oleo oil and neutral lard. The finely minced fat is allowed to flow through the spout *s* of the apparatus shown in Fig. 7, *Packing-House Industries*, Part 1, into the melting kettle *D* until the kettle which has been previously warmed before starting, is filled to within a foot of the top. The paddles attached to the shaft *c* stir the mixture continuously during the operation. Heat is applied gradually and continuously to the water in the jacket until, when the kettle has been filled with the minced fat, the temperature is around 155° to 160° F.

The melting fat is cooked at this temperature for 1½ hours when the operation is completed. The paddles are raised free from the fat and a quantity of salt is scattered freely over the surface of the melted oil to cause the scrap and water in it to settle below the oil. The material is allowed to rest for 20 or 30 minutes when the clear, supernatant oil is carefully siphoned off by means of the attached siphon the outside leg of which is shown at *e*.

The oil flows through a cloth strainer, to remove floating scrap, into the kettle *F*, where a further separation of fine scrap and moisture takes place. After remaining here at a temperature of not less than 130° F. for an hour, the oil is again siphoned by the pipe *g* into the settling kettle *H*. All these kettles are provided with water-jackets as experience has shown that a dry heat on oleo oil is very detrimental to its quality.

The oleo oil remains in the final kettle for not less than 3 hours at a temperature not over 130° F. From this kettle it is run into seeding trucks at a temperature of 130° F. A few degrees from this either way materially alters the character of the *stock*, which is the term for the seeded, or grainy, mixture of oil and stearin. The warm material in the seeding trucks is placed in a room that is free from drafts and protected from direct sunlight and allowed to remain there for 48 hours. This is done so that the stock will resolve itself into the oily and the hard parts of the original tallow or into olein and stearin. The temperature of the seeding room must be steadily maintained at 90° F.

The scrap and water remaining in the melting kettle *D* is withdrawn through the valve *k* and sent to the tallow-rendering tank so as to get the tallow not obtained at the mild melting temperature. The kettle is thoroughly cleansed, when it is again ready for another charge.

25. Pressing the Oleo Stock.—After the stock in the seeding trucks has assumed the required condition for pressing, it is taken to the pressing room. The oil and stearin by this time are distinctly separated, yet intimately mixed. The material is thoroughly and uniformly mixed with the hands, placed in cloths laid over a mold, and wrapped in the form of a cake. To facilitate working these molds are made on a circular revolving table so that with one man filling cloths, one folding into cakes, and another placing them in the press, the work proceeds very rapidly.

26. The form of press used for this work is illustrated in Fig. 4, the iron press plates not being shown. This press is known as the knuckle-joint press, and is run by power. The speed of the press is regulated by pulleys for a rapid or slow descent as desired.

27. The cloths for pressing the stock are of heavy, closely woven duck, strong enough to withstand the high pressure applied on them. This point is one of many where close attention to small details is necessary in order to produce a high-grade article. Neglect of this point alone would be the cause of an inferior product even if all other parts of the manufacture were properly carried out. After each day's

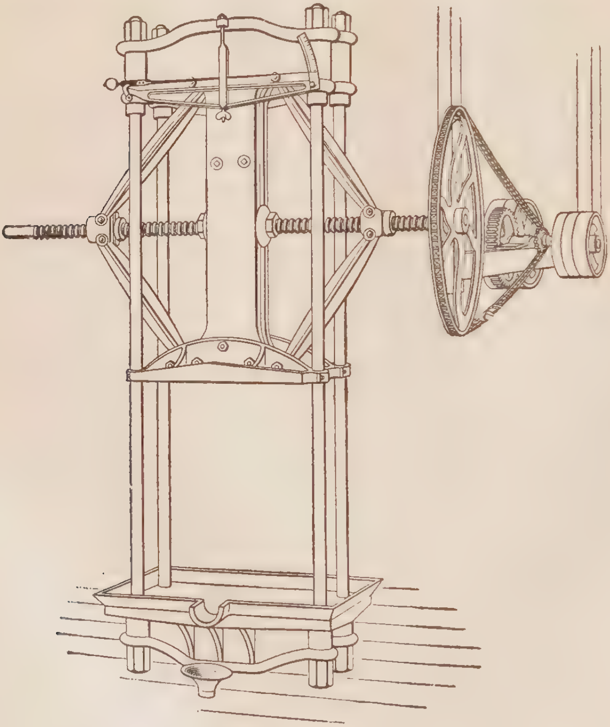

Fig. 4

run the press cloths must be thoroughly washed and dried. While cloths for pressing other oils may be used several times without washing and drying, those for pressing oleo oil are used only one day.

The material folded in the cloths in the form of cakes is placed in the press on the bottom fixed plate until the latter is covered with a sufficient number of wrapped-up cakes. A sheet-iron plate is then inserted in the press and dropped on the cakes. This plate in turn is filled with material and another plate inserted above, this performance being repeated until the press is filled to its capacity, which varies with the size of the press used. The oily part of the stock begins to run out long before the press is filled, owing to the weight of the upper plates and material pressing on the lower layers. This is the oleo oil, or, as it is termed in Europe, oleomargarine. This term must not be confounded with the American name oleomargarine, which name applies exclusively to factitious butter, or butterine.

The oil flows to the settling receptacle which should be water-jacketed, the flow of the oil being augmented by the ram of the press slowly descending and pressing the material. The speed of the press while pressing is very slow, occasional periods of rest from descending being allowed in order to give the oil time to ooze from the stearin. The operation of pressing is completed in about 30 minutes, but the stearin in the bags has the pressure left on it an hour or so longer, to give the material ample time to drain. When the stearin is free from oil, the ram of the press is rapidly raised by the fast motion of the press and the latter unloaded, the operation being exactly the reverse of filling. The oleo stearin is removed from the cloths by unfolding and shaking them and the press is then ready for another charge. The temperature of the press room should always be maintained around 90° F.

There is always more or less waste incidental to the pressing of oleo or any other material. This waste is practically recovered when washing the press cloths, utensils, etc., and in the case of oleo stock is placed with the tallow stearin. The loss on pressing is usually regarded as 1 per cent., and tests are figured on that basis unless the loss is actually shown to be greater.

28. The oleo oil from the pressing is held for a short settling period in the reservoir from which at a temperature of 92° F. it is drawn into tierces. These tierces are immediately placed in a temperature of 55° to 60° F., so that the oil will acquire the requisite grainy condition. The temperature must be kept within these limits to insure successful graining in from 5 to 6 days, and sometimes in even less time. When placed in the graining temperature, the 3-inch side bungs of the tierces are removed, to allow heat and any possible odor to escape.

Oleo oil finds exclusive use in the manufacture of oleomargarine, or butterine. The greater part of this oil is exported to Holland from where it is distributed throughout the various European markets.

Oleo oil should have a titer not exceeding 40° C.; but at times this may be exceeded without detriment, as the oil is not purchased on its titer test but on its physical characteristics, as noted. As the raw fat from which this material is made is kept in a cold, fresh condition, free fatty acids cannot be generated, and, consequently, the free-fatty-acid tests of oleo oil will show ordinarily less than $\frac{1}{2}$ per cent. Good oleo oil contains only .2 or .3 per cent. of free fatty acids. The yield of oleo stock from fat is from 65 to 70 per cent. or more, and the yield from pressing the grained stock is about 50 per cent. each of oleo oil and oleo stearin. This percentage yield is governed largely by market conditions and prices, the manufacturer inclining to the greatest yield in the highest-priced product whether oil or stearin. Oleo oil is colored at times for certain trades by means of pure annatto.

29. Oleo Stearin.—After the oleo oil is pressed out as just described, the oleo stearin is shaken free from the cloths into a bin and from this it is filled into large, thin-staved tierces, which weigh when filled approximately 600 pounds. The oleo stearin is pounded as compactly as possible into these tierces, the object being to have as little air as possible intermixed with the material, and also to have the tierces hold as much material as can be pounded in with a large wooden maul. For export purposes the stearin is sometimes melted and run into tierces, the material in this condition retaining its sound condition for a very long period. Oleo stearin finds a very large outlet in the tanning and leather trades and is used extensively for soap and candle purposes. It is also used in the manufacture of cooking, or edible, compounds.

Oleo stearin is pressed so that it will have a titer of from 48° to 52° C.—generally averaging about 50° C. The harder the oleo stock is pressed, the harder the stearin will be until the limit is reached. This is about 52° to 53° C.; but oleo stearin of this titer is never made commercially. To pass sale requirements, however, the titer must be at least 48° C.

30. Neatsfoot Oil.—The method of obtaining neatsfoot oil has already been described. The grades usually manufactured are as follows: extra-prime neatsfoot oil, prime neatsfoot oil, extra No. 1 neatsfoot oil, No. 1 neatsfoot oil, and winter-pressed neatsfoot oil.

While packing houses make this oil as described, neatsfoot oil may refer to an entirely different sort of product in the oil trade. An oil made from the *fleshings* of the tannery, and other tannery greases, is also called neatsfoot oil. As this oil differs in quality, it is sold on maker's brand, on sample, etc.

Extra-prime neatsfoot oil is unpressed neatsfoot stock, natural color, unbleached, and filtered only, not cold- or winter-pressed. It is used by tanners, compounders of cutting oils, manufacturers of leather dressings, textile manufacturers, silk throwsters, and lace manufacturers. It is also used by pressers in the manufacture of cold-test neatsfoot oil. The free fatty acid is under 1 per cent. and the cold test is about 45° F.

Prime neatsfoot oil has a free-fatty-acid content of 5 per cent. or less and is cold pressed to 40 to 45°, bleached and filtered. Its uses are similar to those of extra-prime neatsfoot oil in such places as will not be affected by the higher acid, especially as a tanning oil for coarser and cheaper grades of leather. It is a shade lighter in color than the extra-prime grade, since it is bleached.

Extra No. 1 neatsfoot oil has a cold test of 40 to 50° and free-fatty-acid content of 12 to 15 per cent. Its uses are similar to other grades of neatsfoot, but for coarser grades of work.

No. 1 neatsfoot oil is used for much the same purposes as extra No. 1 with the additional use in shoe polish. The free-fatty acid is 18 to 20 per cent. and the cold test 40 to 50°.

Cold-test or winter-pressed neatsfoot oil is extra-prime neatsfoot stock which has been winter-pressed to the desired cold test. The free-fatty-acid content varies from 1 to 2 per cent. There are three grades, namely, 20 to 25° cold test, commonly known as 20 cold test; 30 to 35° cold test, commonly known as 30 cold test, and 40 to 45° cold test, commonly known as 40 cold test neatsfoot oil. Their uses are chiefly in the leather and textile industries, the grade used depending on the grade of work for which it is desired. Its chief use is in the tanning of the best grades of leather.

To press neatsfoot oil into winter-pressed oil and neatsfoot stearin, it is necessary to have the oil in a grainy condition. By this is meant a separation of the olein from the stearin—the solid portion of the oil. The pure neatsfoot oil in barrels is placed in a room having a temperature of about 32° F. and kept there for 4 weeks. Various unsuccessful methods to shorten this time have been tried. It is customary to set the barrels on end with one head removed.

After the oil has obtained the condition for pressing it is placed in cloths of closely woven duck. The cloths when folded contain about 5 pounds of material. In pressing this oil, a double cloth for infolding the material must be used, or an oil of low cold test will not be obtained. The temperature of the press room should be kept steady, at 28° to 30° F., when the pressed oil, using double cloths, will have a cold test as low as 14° to 16° F. The manufacturers, however, will seldom guarantee winter-pressed neatsfoot oil to withstand a cold test under 20° F., owing to the variable and uncertain methods of making the cold test by purchasers.

31. Pressing of Neatsfoot Oil.—The details of pressing neatsfoot oil are as follows: The cloths are placed on an upright wooden mold made so that the cloths when folded form a bag about 9 in. × 6 in. × $1\frac{1}{2}$ in. These bags are placed on the bottom of the press, Fig. 5, with room between them to allow for the spread in pressing. A plate of sheet iron is then placed on these, thus forming another bottom for making the second tier of bags. This operation is repeated until the press is filled with layers of bags alternating with the separating plates of iron. The top plate *b* is usually of wood strong enough to withstand the pressure without bending, thus keeping a flat surface and an equal pressure on the top layer. The chains attached to the ratchet *h* are then connected to the bar *c* on both sides by means of iron links.

The slack in the chains is taken up by raising and lowering the lever *k* until the lever remains raised in the air. The framework *a*, *a* of the press is made of strong angle iron in which the plates fit easily at the corners, so that they can follow down the pressed bags of oil. The lever *k*, at first without weights, is raised as soon as it falls to the floor. When the resistance offered by the material in the bags keeps it from falling, a cast-iron weight *m* is placed on one of the notches in the lever, and the lever thus weighted is again raised as fast as it falls to the floor. When the lever remains suspended with one weight another weight *m′* is added, and the

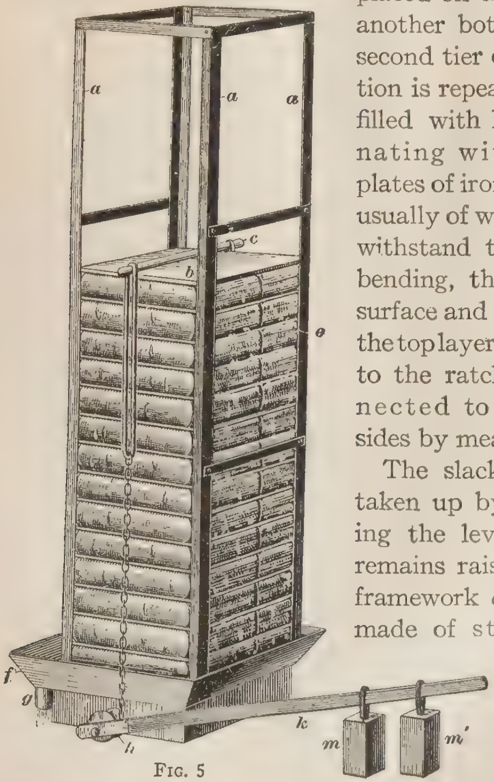

FIG. 5

same performance is repeated until, with both weights on, the lever remains in the air. The material in bags during this time is being constantly deprived of the liquid portion, which flows to the reservoir through *g* from the pan *f*. This oil is neatsfoot oil of low cold test, not congealing much above 14° F. The cold test of the oil above this point may be regulated by the temperature of the press room, but it is neither practicable nor profitable to produce oil that will withstand a lower cold test than that just mentioned.

The time required to complete the pressing is about 3 days, the pressing proceeding very slowly after the bulk of the oil has oozed out. The lever must be frequently raised during the first day, and thereafter about twice every 24 hours.

The form of press shown in Fig. 4 is also extensively employed in pressing neatsfoot oil and greases and may be used to advantage where circumstances permit.

32. The material remaining after pressing is actually neatsfoot stearin, but it is seldom sold as such. The close approach in its nature, composition, and cold test to tallow oil makes its sale as that commodity legitimate. In warm weather neatsfoot stearin may be sold for neatsfoot oil, since the cold test at this season is not important. This stearin may also be returned to the ordinary neatsfoot oil where the cold test is not essential.

The bags, or cloths, are shaken free from the pressed material, when they are ready for use again without washing. Cloths for pressing neatsfoot oil may be used four or five times without washing, but the texture is gradually closed up by wax-like stearin, which must be removed. The neatsfoot stearin is simply melted and either barreled for neatsfoot oil or used and sold for tallow oil.

Winter-pressed neatsfoot oil is extensively employed as a lubricant for very fine instruments. The pressed oil is usually heated to eliminate accumulated moisture and is filtered to remove extraneous contaminations and dirt. The pressed oil may be but seldom is bleached white by means of fullers' earth. The sale for this class of oil is very limited. The process of bleaching is in every way similar to the bleaching of lard, which has already been described.

33. Lard Oils.—Lard and grease are used for making lard oils, the operations being carried out in the same kind of presses that are used for pressing neatsfoot oil. The press shown in Fig. 4 is the more modern style and gives quicker results. While the form of press shown in Fig. 5 is largely used, it is being replaced wherever possible by the knuckle-joint press. In large establishments several of these presses, Fig. 5, are arranged side by side, the pan *f* being made sufficiently long to accommodate all the presses. One outlet *g* serves to drain the oil from all the presses. The axles of the presses are placed at such an angle that the levers clear themselves in falling. The advantage of arranging several presses in this way is that while one press is having the material pressed, another may be filled. As it requires from 2 to 3 days to press oil out of lard and grease, the advantage of such an arrangement is obvious.

34. Pressing of Lard Oils.—The same method as that just described is used for pressing lard and greases. Much greater care, however, is required in handling the lard both before and after pressing, than is necessary with greases or ordinary lard oils.

The lard is made into a grainy condition suitable for pressing. The more marked and complete the separation of the olein and stearin of the lard, the better and easier it can be pressed. Lard or grease that has not been made into a grainy condition is not susceptible of pressing, as the oil and stearin, being intimately mixed and in a smooth, plastic condition, resist separation by pressure. To obtain the material in the requisite form, the lard or grease, after being filled into the receptacles in a molten condition, is allowed to remain quiet for 3 or 4 days in a temperature of about 60° F., when the separation of the material takes place. A longer period of graining will do no harm and at times is a positive advantage as under favorable conditions a most complete separation of the oil and stearin ensues, enabling the lard oil to be dipped from the stearin almost completely. Many small concerns are thus in a position to obtain oil and stearin without the use of a press. This, however, is not a general way of obtaining the lard oils.

The grainy lard or grease is filled into cloths in the same manner in which neatsfoot and oleo oils have been and is placed in the press, layer on layer, until the press is filled as tight with material and plates as practicable. The process is similar to that of pressing neatsfoot oil. With lard and grease, a single cloth is sufficient to permit the lard oils to flow through and at the same time retain all the stearin in the cloths.

35. Grades of Lard Oils.—Eight grades of lard oils are ordinarily manufactured, although certain presses may market a larger or smaller number. These grades with a brief description of each, follow:

Prime winter strained lard oil is used largely by railroads and oil compounders in making signal oil and in the manufacture of fine lubricating oils and by silk and textile manufacturers in the preparation of spindle lubricants. The free-fatty-acid content of this oil is under 2 per cent. with a cold test of 45°.

Special prime lard oil is specially prepared for use as burning or signal oils, meeting all requirements for this class of oils. The free acid and cold test are the same as for the preceding grade.

Extra winter strained lard oil is used largely by compounders of fine lubricating oils of various kinds, especially for high-speed and splash oils and also by silk and textile manufacturers for spindle lubricants. It is sometimes used by brass manufacturers in moulding operations. The free fatty acid may run as high as 4 per cent. and the cold test the same as the above two grades.

Extra lard oil is used for practically the same purposes as the preceding, the main difference in the oil being that the fatty acid may be as high as 5 per cent.

Special extra No. 1 lard oil is used largely by machine shops for screw and thread cutting and all kinds of machine cutting of better grades. It is also used in making compounds of lard-oil substitutes used for the same work. It is sometimes used in the manufacture of lubricants and by gun manufacturers for rifling guns. The cold test runs from 45 to 50° and the fatty acid from 7 to 9 per cent.

Extra No. 1 lard oil usually runs from 12 to 15 per cent. free fatty acid and the cold test from 45 to 50°. Its uses are similar to those of the grade immediately preceding.

No. 1 lard oil is used for all kinds of coarse thread, screw, and die cutting, and by compounders of thread and die-cutting compounds and cheaper lubricants. It is also used to some extent in the textile trade for the manufacture of lower grades of cotton and woolen fabrics and carpets, to soften the product in the manufacture. The cold test runs from 45 to 50° and the fatty acid from 18 to 20 per cent.

No. 2 lard oil finds uses similar to the preceding oil and for coarser cutting such as bolt cutting. The free fatty acid is from 25 to 30 per cent. and the cold test from 45 to 50°.

36. Bleaching Requirements of the Several Grades of Lard Oils.—All the oils after pressing are allowed to settle in the receiving tanks until a sufficiently large quantity has accumulated to filter and, if necessary, to bleach. The oil is placed in the bleaching tank, the air blower started, and the oil heated and agitated until the temperature reaches 160° F., when the necessary quantity of fullers' earth is added and the hot oil and suspended clay are pumped through the filter press. The bleached and filtered oil is sent to the storage tanks from which, after the oil has been allowed to cool to normal temperature, it is drawn into the regulation oil barrels. It is necessary to allow hot oil to cool before filling the barrels. This is done so that the oil will not acquire cloudiness in the barrels while cooling. Such oil is technically termed *off*.

It is evident that the color of lard oil will depend on the color of the grease from which it is pressed. When the color of the oil is not up to the standard set by the free-fatty-acid and cold test, it is customary to bleach the oil by the above process.

37. Lard and Grease Stearins.—After the oil has been pressed from the material the stearin remaining is shaken free from the press cloths, and when a sufficient quantity of it has accumulated, it is melted, mixed to insure uniformity, and run into tierces.

Lard stearin is used to stiffen refined and mixed lards, thereby causing such lards to withstand warm weather without melting. This stearin is only rarely used in lard compound.

Grease stearins are divided into several grades corresponding to the greases from which they are made. That from grade A white grease is branded white-grease stearin and is used by soap manufacturers. The stearins from grade B white and yellow grease are both classed as yellow-grease stearin, no distinction being made between them. This stearin is used almost exclusively in soap manufacture, having a titer somewhat higher than the usual trade tallow; large quantities are also exported. Brown-grease stearin is seldom met with in trade, it usually, and then very rarely, being made on order in the packing houses. This material is used for distilling into olein and stearin and at times for soap making.

The requirements of stearins are limited to the titer, or hardness, and the amount of moisture and impurities they contain. The titer required of lard stearin must be at least 44° C., and it must not contain over 1 per cent. of moisture nor any impurities. White-grease stearin, as well as yellow-grease stearin, is sold at a price corresponding to its hardness and the amount of moisture and impurities it contains. These stearins are usually pressed to a hardness of 43° or 44° C., and contain, as a rule, less than 2 per cent. of moisture and impurities combined. The rapid methods of determining these, as practiced in packing-house laboratories and at the present day by many tallow and grease brokers, will be given later.

38. Tallow Oil.—With the exception of modifications as to temperature in pressing, tallow oil is made similarly to lard oils. Like lard and grease, the tallow must be in a grainy condition before it can be successfully pressed; and, similarly, the better the separation of the olein from the stearin in the seeding receptacles, the quicker and better the separation of the oil in the press.

The molten tallow for pressing is drawn into suitable receptacles such as open-headed barrels or trucks and allowed to stand for 5 days at a temperature of from 75° to 85° F. The tallow by this time will have resolved itself into the components of oil and stearin and is ready for pressing. It is unwise to allow the grained tallow to remain without pressing longer than this period, as the stearin grains will constantly increase in size and unite with the olein, in consequence of which it will be very difficult to press out the required yield of oil.

39. Pressing and Bleaching Tallow Oil.—The grained tallow is manipulated in the same manner as grease, and when made ready in the cloths for pressing, it is filled into the mold in the way already described. The cakes are placed in the press, Fig. 4 or Fig. 5, and the operation is completed in the usual way. The tallow is pressed for 2 or 3 days at a temperature of about 85° to 90° F. The higher the temperature of the press room, the greater will be the yield of tallow oil; but, on the other hand, the cold test of the oil will be quite high owing to the greater quantity of stearin melted into the oil. This procedure of pressing at a high temperature is practiced at times when the price of the oil is higher than that of the tallow stearin. The usual yield, however, is from 45 to 50 per cent. of oil from the tallow.

The oil is conducted to a reservoir until a sufficient amount has collected for filtering and, if necessary, for bleaching. Tallow oil is ordinarily of a very light yellow or white color. If the pressed oil is satisfactory in color, it is bleached in the usual manner by from 3 to 6 per cent. of fullers' earth, depending on the stock. The temperature at which the material is bleached is of no particular consequence, as this oil is not used for food purposes. A good temperature is around 140° F. The oil need not be bleached to a water-white color, as this is not an essential. This oil is used in compounding with mineral lubricating oils.

40. Acidless Tallow Oil.—The first step in procuring acidless tallow oil is to obtain the ordinary tallow oil as just described. In selecting tallow for this purpose, it should not exceed 4 or 5 per cent. of free fatty acids, as, when pressed, these free fatty acids are practically doubled in their relative percentages in the pressed oil, the material left in the cloths—tallow stearin—retaining a very small part of them. The less free acid a tallow contains the less shrinkage will there be in the operation of making it acidless. The operation is carried out in the following manner:

The oil is brought into the treating tank which is similar to the bleaching tank shown at *A*, Fig. 5, *Packing-House Industries*, Part 1, and may be used as such, the suitable connections being provided. This tank must have the cock *m* about 4 or 5 inches wide in order that the soap formed may be withdrawn through it. The other attachments of this tank are the same as for the regular bleaching tank. The oil is brought to a temperature of from 125° to 135° F., and the percentage of free fatty acids having been previously ascertained, sufficient solution of caustic soda is added to combine with the free fatty acids present. The caustic solution is made with a strength of 20° Baumé, as this strength has been found best for this purpose. During the addition of the alkali the oil is constantly agitated with the air blower.

In a few minutes the reaction is complete, when the oil is allowed to stand at rest for 5 minutes to allow the soap formed by the combination of the alkali and the fatty acids to collect on top of the oil. A portion of the soap will sink to the bottom with the excess of water. The floating soap is removed by skimming and the soap in the bottom of the tank is removed, together with the water, through the cock *m*. The oil is then agitated to cause the remaining soap to gather together. This soap is also removed in the same manner and the oil is now washed with clean water and agitated strongly with the air blower. This washing serves to remove the last traces of soap and any excess of alkali present. The wash water is then drawn off and the oil is heated to 165° or 170° F. and blown until the last traces of moisture have been removed. The oil is now ready for bleaching and filtering which are carried out in the usual manner. Acidless tallow oil is always bleached after being made acidless and, as mentioned before, the same tank may be made to serve for the complete operation.

41. The chief trade requirement of acidless tallow oil is that it shall contain not more than ½ per cent. of free fatty acids. The cold test of this oil is of no material importance, although it is generally made to stand a test of about 65° F. Other conditions being equal, the whiter the color, the more acceptable is the oil.

Acidless tallow oil finds its greatest use in compounding with mineral lubricating oils, where the absence of all acidity is of the highest importance. It is also used alone as a lubricant for machinery. This oil, as made in the large packing houses, seldom contains over .2 per cent. of free fatty acids. The soap formed in the manufacture of acidless tallow oil, when a sufficiently large quantity has accumulated, is decomposed with sulphuric acid of 66° Baumé in a lead-lined tank. The resulting fatty acids, black in color, may be mixed if desired, in small quantities at a time, with No. 2 tallow.

42. Tallow Stearin.—The material remaining in the cloths in the press after the oil has been pressed out of the tallow is tallow stearin, corresponding to the grease stearin resulting from the operation of pressing grease. The tallow stearin is shaken free from the cloths, melted, and run into barrels or tierces while warm. The hardness of this material depends on the quality of the stock from which it is derived and also on the amount of pressure to which the tallow is subjected. In general, it will have a titer of 46° or 47° C. This material, like tallow, is purchased on the result of the titer test. Tallow stearin finds utility in the currying and finishing of leather and in the candle industry and at times is used in the manufacture of high-grade soaps.

43. Bleached Tallow Stearin.—In order to obtain bleached tallow stearin, it is simply necessary to bleach the foregoing product to a white color with the required amount of fullers' earth. The bleaching is done in the usual manner, no notable quantity of fullers' earth being required to produce the desired white bleach. The industrial uses of this product are the same as for the ordinary tallow stearin, which is not usually bleached unless required for special trade; it is then always sold at a corresponding advance in price.

44. Bleaching of Oils.—The bleaching of oils is carried out in the same manner as that of lard. With lard and tallow oils, however, the process need not be so carefully conducted with respect to temperature, etc.

The temperature required for obtaining the requisite bleach in oils is higher than that required for lard and tallows. But here, also, the lower the degree of heat at which the oils may be made to bleach the better will be the odor of the product. As these oils are not used for food purposes, the taste and odor are not of so much importance as with lard, and the use of an excess of fullers' earth in bleaching is not so closely observed except as a matter of cost.

The quantity of fullers' earth necessary to bleach a given oil varies with the nature of the material. While one oil will bleach with 2 or 3 per cent. of fullers' earth, another similar oil may require 7 or 8 per cent. When more than the latter quantity is necessary, as shown by preliminary tests, bleaching is not attempted, as the increased value of the bleached oil would not equal the cost of the labor and fullers' earth used in the operation.

45. Bleaching Test.—The oils may be tested for the amount of fullers' earth necessary to bleach by taking an ordinary 4-ounce, oil-sample bottle and weighing in 100 grams of the oil under consideration. The percentage of fullers' earth judged necessary to effect the bleach is weighed off and then added to the hot oil in the bottle. By placing the oil and bottle in a steam bath for several minutes previous to adding the fullers' earth, a temperature closely approximating that obtained in the bleaching tank is obtained. If necessary, the temperature of the oil, which must be at least 170° F., may be tested with a thermometer.

After adding the fullers' earth, the bottle is closed and violently shaken for 3 or 4 minutes to effect the bleach. The mixture is then poured on a filter paper placed in a hot funnel, and the color of the filtered oil observed. If not satisfactory, another test is made, using a larger quantity of fullers' earth. In this way, the amount necessary for the quantity of oil can be determined before starting to bleach. It should be remembered, however, that this test is crude and only comparative, as the conditions are not the same in the bottle as in the bleaching tank with the air-blower agitation. An oil will always be bleached in the tank with a smaller quantity of fullers' earth—approximately from 1 to 1½ per cent. less—owing to the better agitation and more intimate and continuous contact between the fullers' earth and the oil.

46. In bleaching oils the same precaution as with lard must be observed—that is, to have all moisture eliminated before adding fullers' earth—or no bleach will be obtained. After the bleached oil oozes from the filter press in a bright, sparkling condition unlike lard, it is run to a cooler, or tank, where it is allowed to cool to room temperature before being drawn into barrels.

The apparatus shown in Fig. 5, *Packing-House Industries*, Part 1, is used in the bleaching of oils. After low-grade oils have passed through the apparatus everything with which it has come in contact must be thoroughly cleaned so as to remove all traces of free acid and odor.

BEEF EXTRACT

47. In the making of beef extract in the packing house, the product of beef only is used. Beef extract is a very profitable product, as in most cases waste liquors, washings and waters from the boiling of meat, which are practically without value for other purposes, can be used to advantage.

The National Formulary of the American Pharmaceutical Association has the following description of beef extract and tests for its purity:

> Beef extract is the residue obtained from fresh beef broth by evaporation at a low temperature.
>
> A yellowish-brown to dark-brown, slightly acid, pasty mass having an agreeable meat-like odor and taste.
>
> Twenty-five grams of extract of beef, diluted to 250 mils* with distilled water, yields a solution almost clear and free from sediment. Separate portions of this solution respond to the following tests:
>
> Boil 10 mils of the solution for 1 minute with 1.5 grams of purified animal charcoal; add distilled water to replace that lost by evaporation and filter; the filtrate produces no blue coloration when 1 drop is added to 3 drops of a solution of diphenylamine (1-100) in concentrated sulphuric acid (nitrate).
>
> Distribute 10 mils of the solution over dry sand or asbestos and dry to constant weight in a flat-bottomed porcelain dish in an oven at a temperature of 105° C.; it yields a residue of not less than .75 gram equivalent to 75 per cent. of solids in the original extract.
>
> Incinerate the residue from 10 mils of the solution obtained in the preceding test; the ash does not exceed 30 per cent. of the residue nor does the sodium chloride in the ash exceed 10 per cent. of the residue when determined as directed under the assay for chlorides.

The manufacture of meat extract as carried on in the packing houses and the meat-canning establishments of the United States is merely a side issue, and comprises essentially only the concentration of suitable meat juices to a proper consistency. Only on rare occasions is fresh meat used especially for meat-extract purposes and even then it is only head meat or cheek meat, hearts, and other cheap meats, and these only when sausage meat is a drug on the market.

For a short period some packers that make sausages on a large scale thought it profitable to soak all their sausage meat thoroughly, press the juice from the meat, and use this juice for meat extract. While they found this profitable for the extract department, it was greatly to the detriment of the sausage department. Sausages made of such extracted meat have a very flat taste and no keeping qualities.

The so-called *cellar waters* in which fresh meats have been soaked, the waters from the cooking or scalding of meats for canning, and certain bone liquors, hereafter described, constitute the main sources of beef extract. The entire manufacture from such liquors is quite simple and relatively inexpensive, the cost being practically the labor and steam employed. Figs. 6 and 7 illustrate the apparatus used in the manufacture and show the principle of the operations.

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* A mil is equivalent to 1 cubic centimeter.

Beef extract is described by the regulations of the Bureau of Animal Industry as follows:

> Such terms as "meat extract" or "extract of beef," without qualification, shall not be permitted on the labels in connection with products prepared from organs or parts of the carcass other than fresh flesh. Extract prepared entirely from parts of the carcass other than fresh flesh shall not be labeled "meat extract," but may be properly labeled with the true names of the parts from which prepared, as, for example, "liver extract." The term "beef extract" and "extract of beef" without qualification shall be applied only to extracts of fresh beef. Extract of cured beef or of other cured meat shall be designated respectively as "extract of cured beef," "extract of cured meat" or "cured-meat extract." In the latter case "cured" and "meat" shall appear on one line in the same style and size of lettering and shall be connected by a hyphen. When beef extract is mixed with extract from cured meat or extract derived from other parts of the carcass, such mixtures shall be designated as "compound meat extract," and, in addition, there shall appear on the label a statement showing the ingredients other than fresh flesh, which have been used in preparing the extract. In the case of fluid extract the word "fluid" shall also appear on the label, as, for example, "fluid extract of beef." The word "fluid" merely indicates a lower percentage of solid matter.

48. The system of making meat extract by soaking the fresh meat with a relatively small amount of water and then pressing the juice from the meat with powerful hydraulic presses, is operated in the United States by only one small concern to a very limited extent. If prepared with the greatest care, a great deal of skill and experience, and in the very best obtainable vacuum (of about 29 inches barometric pressure, at a temperature below 120° F.), requiring a special and expensive vacuum pan, this meat-juice extract represents a very superior article and brings a high price, but the market is very limited. This process is too expensive to be employed in the ordinary meat-canning or packing establishments.

49. Process of Manufacture of Beef Extract.—The method of manufacturing beef extract from meat liquors, etc., is carried out in the following manner:

The scalding liquors (soup waters) from the cook room of the canning department, bone liquors, etc., are pumped into the wooden vat *A*, Fig. 6, which is about 2 feet high and of suitable length and width to hold 1 day's soup liquors, etc. Steel vats are also used for this purpose.

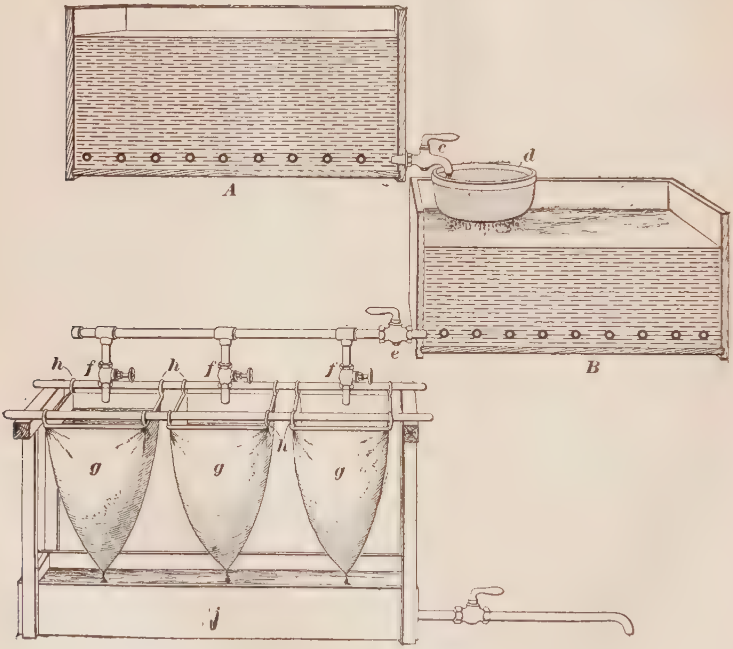

FIG. 6

Instead of using one very large tank, it is advisable to use two or three smaller ones. The tank or tanks are provided with 1-inch steam pipes that are placed sufficiently far apart to permit the pipes and the bottom of the vat beneath them to be readily cleaned. The tanks are slightly inclined toward one corner to facilitate complete draining and washing out.

The soup liquors and bone liquors are boiled down in tank *A* to about $\frac{1}{2}$ or $\frac{1}{3}$ their original volume. Then an equal volume (or about) of cellar water (from the soaking of fresh meat) is pumped into the soup water. By continued heating of the mixture the albumin in the cellar water is coagulated, and while coagulating envelops all the suspended impurities, defibrinated blood can be used to accomplish the same result. Steam is turned off and the liquor is allowed to settle. The amber-colored clear liquor is drawn from vat *A* through cock *c* and the hair sieve *d* into the vat *B* which is arranged similar to vat *A*. In vat *B* the liquor is further concentrated to a density of about 7° or 8° Baumé. If the liquor shows any tendency to become cloudy or off-colored a little more cellar water is added to it, thus producing a second coagulation and clarification of the liquor. Steam is then shut off from vat *B* and the liquor is drawn through cock *e* and the valves *f* into filter bags *g*. These bags are made of cotton flannel (about 15 inches square on top and 2 feet deep) and are suspended by hangers *h* from a suitable rack. The gutter *j* catches the clear, filtered liquor and conveys it to the rotary evaporator.

It is entirely practical to use filter presses instead of bags if the amount of liquor is sufficiently large.

50. The rotary evaporator, Fig. 7, consists of a steam-heated, revolving drum *n* that is driven by a belt from the pulley *o*. This drum, which is about 3 feet in diameter and from 5 to 10 feet long, revolves in a trough *l* that is supported by the legs *m*. At the back of the steam-heated roller *n* and at its side, scrapers, which serve to keep the surface clean, are arranged. In addition, the entire roller is supported in a frame that permits the raising and lowering of the roller according to the amount of liquor present.

The amount of liquor in the trough *l* is so regulated that the drum *n* dips into it only to about the depth shown by the dotted line *r*. The steam drum is so constructed as to withstand a considerable boiler pressure, but it is usually run with not more than a pressure of 20 pounds per square inch, and very frequently with less. In its revolutions (about 25 to 40 per minute), the drum carries sufficient liquor on its surface to prevent complete drying and burning. When the desired density is reached, which is about 20° Baumé for the fluid extract and 32° Baumé for the so-called solid, or paste, extract, the concentrated liquor is drawn through cock *q* or dipped over the edge of the trough *l* into suitable receptacles, from which it is filled into bottles or jars. Such is the principle of the most simple and inexpensive and yet convenient meat-extract apparatus in operation.

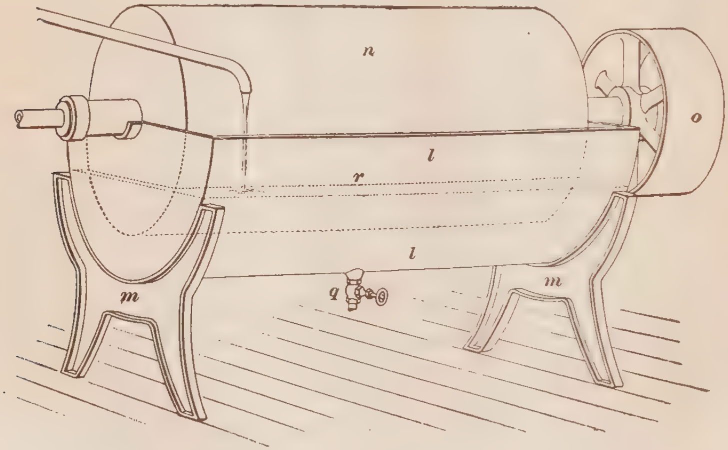

Fig. 7

51. However, simply because better evaporators are offered in the different multiple-effect evaporators, the larger packing houses and many others have abandoned the use of roller evaporators. But these multiple-effect evaporators are only suitable for operations on a large scale when from 10,000 to 50,000 gallons of meat liquors is concentrated in 24 hours. For a small concern the labor and attention demanded by these evaporators require too great an expenditure, and thus overcome their principal advantage—the saving in fuel.

A rotary evaporator will evaporate for each pound of steam delivered to the apparatus about $1\frac{1}{5}$ to $1\frac{1}{4}$ pounds of water, thus getting an evaporation of about 10 pounds of water from each pound of coal. The average double-effect evaporators give 16 pounds of water evaporation for each pound of coal of the same class; the triple-effect evaporators give 24 pounds of evaporation. The rotary evaporator is very suitable for the concentration of tank liquors or tank waters on a small scale and is used for this purpose by some packers.

Small single-effect vacuum evaporators are made for handling extract in small plants.

In making extract in an evaporator of this type it is necessary to finish the product in small vacuum kettles. The diluted liquors are concentrated for the evaporators in open boiling tanks in the same manner as for the rotary evaporators.

52. Soup Liquors and Rib Bones.—For making meat extract the cooking and scalding waters of fresh meat and the cellar waters (*soak* waters from fresh meat) can be used if they are sweet and in sound condition. Cured-beef extract is made from corned-beef and other soup waters.

All canning bones, that is, bones from meats cut for canning, thigh bones, etc., give, when heated for 1 or 2 hours with lukewarm water (about 165° F.), a bone liquor that is extremely well adapted as an addition to the soup liquors in the manufacture of meat extracts. Care must be taken, however, not to use the water too long or too hot on the bones, as in such a case the liquor will dissolve too much gelatine and give to the meat extract a gluey flavor. For the same reasons, bone liquors alone do not make meat extract, but when blended with soup liquors and cellar waters an excellent beef extract results.

Where large quantities of cheap meat are available for beef-extract purposes, such, for example, as hearts, cheek meat, etc., the meat is cut into small pieces—about 1-inch cubes or thereabouts. This meat is then soaked in ice-cold water for 24 hours, the mass being frequently stirred with forks. After 24 hours the first water is drawn off and pumped into tank *A*, Fig. 6. Then a second quantity of water is put on for another 24 hours, this water also being sent to tank *A*. In former times hydrochloric acid in the proportion of 1 gallon of acid to 250 gallons of water was added to this water so as to get a better yield; but, according to a decision of the Secretary of Agriculture, hydrochloric acid can no longer be used in the manufacture of meat extract.

The cold, extracted meat is then sent to the cook room where it is cooked for from 3 to 4 hours in the scalding tubs, or for 2 hours in iron digesters at a steam pressure of 20 pounds per square inch. The residue of this cooking either goes into the tankage or is occasionally sold for dog biscuit and other similar purposes; at times it is worked into mince meat.

53. All the apparatus used in the manufacture of meat extract must be thoroughly cleaned every day. The tanks *A* and *B*, Fig. 6, must also be kept scrupulously clean not only at the sides and bottoms but especially around the steam pipes. Occasional boiling with soda-ash solution will clean these vats perfectly. The coagulum from these vats, which collects in the sieve *d* and the filter bags, finds proper use in the tankage. The filter bags must be thoroughly cleaned with hot water after each day's use. Occasionally it happens that the liquid in the rotary evaporator turns cloudy because of imperfect previous clarification. In such cases the liquid is conveyed into a steam-jacketed open kettle where either fresh cellar water or defibrinated blood is added and the mass brought to a boil, producing a new coagulation; then by filtration through the bags a perfect clarification of the material is obtained.

54. Forms of Extract.—Beef extract is put on the market in two forms, either as fluid extract or as paste extract, according to the degree of concentration.

55. Fluid extract is concentrated to a density of about 29° to 32° Baumé, and contains from 42 to 48 per cent. of moisture. As a rule, there is an extra amount of common salt added, so as to bring the percentage of salt up to 10 per cent. This requires usually from 2 to 4 per cent., as the meat from which the extract is made furnishes from 6 to 8 per cent. of salt. The extra amount of salt in the fluid extract is necessary to give it better keeping qualities, as no antiseptics or preservatives are ever used in beef extracts. Fluid extract is usually put up for the trade in glass-stoppered bottles; large quantities for storing, etc., are put up in square, 14-pound, meat-canning tins, the cans being processed in dry steam for 1½ hours at a pressure of 10 pounds per square inch.

56. Paste extract is boiled down to a concentration so that the product contains from 20 to 24 per cent. of moisture; it then contains from 55 to 65 per cent. of organic substances and from 8 to 10 per cent. of salt. Paste extract is usually put up for the trade in porcelain or milky-glass jars; but to store or ship in large quantities it is put up in square, 14-pound cans and capped without any processing.

Fresh meat such as roast beef, etc., prepared for canning purposes in the regular way yields about 1 pound of paste extract from 60 pounds of meat (from soup water and cellar water). By longer scalding in the preparation for canning the yield can be raised to 1 pound of paste extract from 40 pounds of meat. If the meat is treated only for extract, that is, if the meat is finely cut, soaked for 24 hours, and cooked to thorough disintegration during 3 or 4 hours, the yield will be about 1 pound of paste extract from 25 to 30 pounds of meat. Bone liquors give ¼ to ½ per cent. of paste from the amount of bones soaked in warm water.

The labor in the beef-extract department (exclusive of the label room) does not amount to much, one man and a helper being able to produce large quantities of extract.

MEAT CANNING

57. The hermetic sealing of food, usually referred to as canning, is an industry that has grown to be an important factor in the commercial and industrial development of the United States. This industry has long since passed the experimental stage and has taken its place among the leading industries of the country.

The process used in the canning of meats is what is known as the Appert process, which was invented in 1809. Although this process has been well known to scientists ever since its invention, its commercial application has been available only a comparatively few years. Up to the present time nothing has been discovered to supersede this universally applied process for the canning of meats and of vegetables.

58. Prior to 1795, drying and the use of salt and sugar were the only methods used to any extent in the preservation of foods. At this time, Nicholas Appert, a Frenchman, who had spent most of his life in the preparation and preservation of articles of food, being stimulated in his work by the offer of a reward by the French Navy Department for a method of preservation of foods for sea service, submitted to his government an exhaustive treatise bearing on the hermetic sealing of all kinds of food. His method was to enclose fruit in a glass jar, which was then corked and subjected to the action of boiling water for a time, which varied with the article treated.

A description of his process can best be summed up in his own words, as follows: "It is obvious that this new method of preserving animal and vegetable substances proceeds from the simple principle of applying heat to the several substances after having deprived them as much as possible of all contact with the external air. It might, on the first view of the subject, be thought that a substance, either raw or previously acted on by fire and afterwards put into hot bottles, might, if a vacuum were made in those bottles and they were completely corked, be preserved equally well with the application of heat in the water bath. This would be an error for all trials I have made convince me that the absolute privation of the contact of external air (the internal air being rendered of no effect by the action of heat) and the application of heat by means of the water bath, are both indispensable to the complete preservation of alimentary substances."

As before mentioned, time has proved Appert's method to be the most satisfactory for preserving food in its natural state.

59. Glass jars, which were originally used for this purpose, were gradually abandoned, as it was found that they could not withstand the extremes of temperatures, and that they were expensive, bulky, and costly in transportation. Although glass jars are used to some extent at the present day for the preserving of vegetables, fruit, etc., tin cans are universally employed for the canning of meat.

The objection having been urged against the use of tin cans that the natural acids of fruits, vegetables, meats, and fish act on the tin and solder in such a way as to form metallic salts or metallic compounds that are injurious to the health, the matter was carefully investigated by expert chemists, who reported that the objection is groundless if good tin is used. In the poorer grades of tin, injurious substances were found, but in such small quantities that they were negligible.

The principle underlying the preservation of meat or other edible substances in air-tight cans is that the decay of organic matter is not due alone to oxidation, but to the action of bacteria, organisms, ferments, etc., which attack and act on the organic substances, decomposing them and resolving them into their original elements or other compounds. The heating of the meat or other material in the process of canning destroys or paralyzes the bacteria and ferments, and the hermetic sealing of the cans prevents bacteria from again entering into the material. Hence, canned goods made of good material and properly prepared remain unchanged and in good condition indefinitely. The process is, in fact, one of sterilization by heat.

60. The meat-canning industry, in connection with the packing industry was started in a small way in Chicago about the year 1877. It was primarily established with a view of saving a large proportion of the meat that up to that time had been either unsalable or of very little value.

The canning industry comprises so many different branches that only the most important features and the general plan and scope followed will be given here.

61. Selection and Preparation of the Meat.—The meat selected for canning is ordinarily taken from lean cattle in good, healthy condition, which are not suitable for beef cattle. Cattle of this kind are known in the trade as canners. These animals are slaughtered largely to obtain meat for canning purposes. The parts of the beef that cannot be sold at a profit go to the canning department of the establishment. The hind quarters, loins, and, in some cases, salable fore quarters are sold in the fresh state. The fore quarter, however, furnishes the bulk of the meat for canning purposes. One reason for this is that there is less fat on this part of the animal.

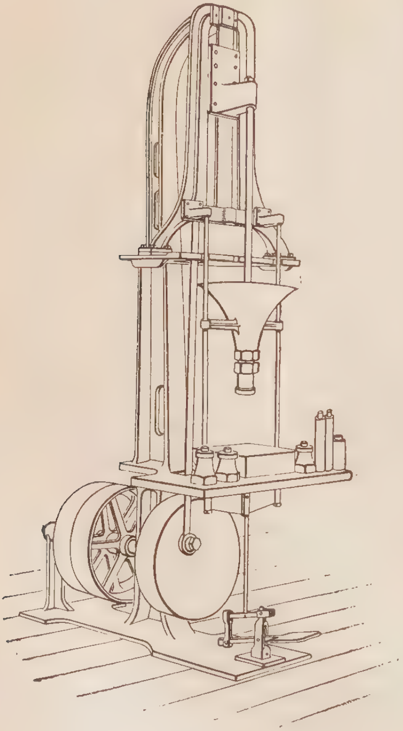

Fig. 8

The fore quarter is taken to the boning room, and the bones are removed entirely from the meat. This meat is cut into pieces of about 5 or 6 pounds each, in order to facilitate curing uniformly throughout when placed in pickle for the making of corned beef. Great care is exercised not to leave even small bones in the meat, as they are liable to break the stuffing machine and otherwise cause delay by stopping this machine when the meat is being stuffed into cans. The small pieces of meat are cured by themselves and mixed with the larger ones when canning.

62. Curing and Cooking the Meat.—The meat is cured in a mild pickle in which are placed small quantities of saltpeter and sugar, the former not exceeding 4 ounces to each 100 pounds of meat, and the latter varying in quantity from

1 to 2 per cent. The meat after remaining in this pickle from 15 to 26 days is cured and ready for boiling or shrinking. After washing in cold water to remove the pickle, the meat is placed into boiling vats. These are wood-end vats that hold at each charge about 700 pounds of meat. The time of cooking varies with different meats. For canned roast beef the meat is not subjected to the curing process, but is cooked while fresh in boiling water for 20 minutes. The cooked meat is then removed and stuffed into cans by the can-stuffing machine, shown in Fig. 8, after the requisite amount has been weighed off. In canning the meat suffers considerable shrinkage in weight averaging about 20 per cent. with roast beef.

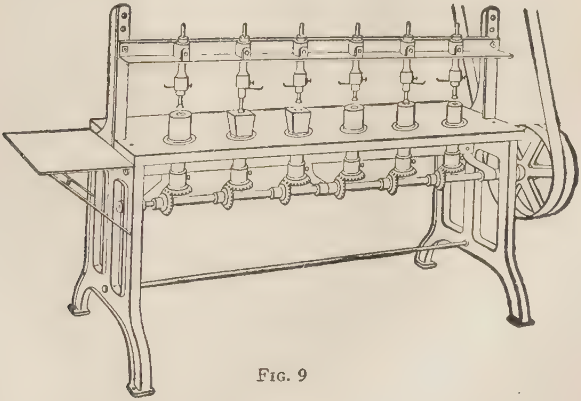

Fig. 9

For cooking corned beef the meat is boiled for 10 minutes, after which it is allowed to stand in the hot water for 1 hour. This method freshens the meat and also causes far less shrinkage than by another common method of boiling it for 1 hour. The average shrinkage in cooking corned beef is about 38 per cent., although at times it is not more than 30 per cent. The soup water from the cooking or shrinking of meats is used for making soups and also in the manufacture of beef extract.

63. Canning and Processing.—When the meat is removed from the cooking tubs it goes to the cutting table, where it is cut into sizes suitable for the stuffing machine; it is then passed to the weighing table where the proper amounts are weighed off and fed to the stuffing machine. After the cans are stuffed they are reweighed, wiped, the cap placed over the opening through which the meat was stuffed, and inspected. The cap is soldered on when the can is on the capping machine shown in Fig. 9. The meat is then ready to be processed, or cooked in the can, by one of the three methods which follow:

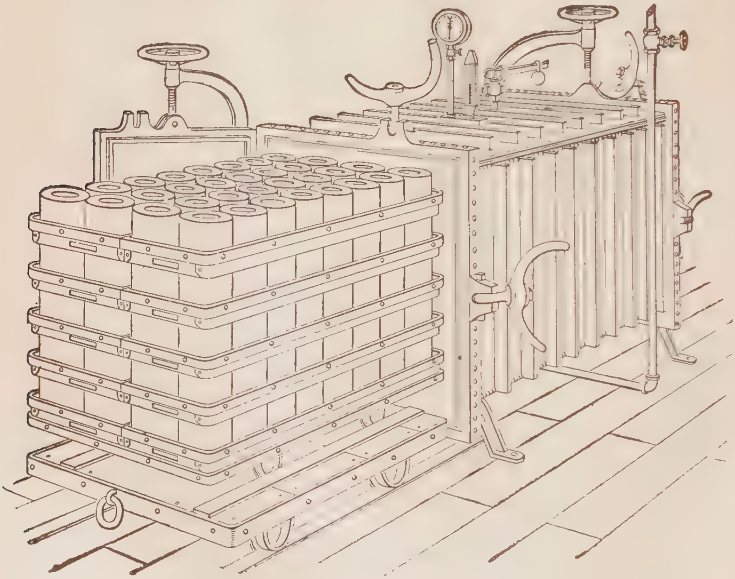

Fig. 10

64. In the **boiling-off process**, after going through the capping machine the small hole in the center of the cap, the vent, is finally closed with solder, when the can is ready for the first of the two cookings necessary in this process. This may be done either in a water bath or in a retort like that shown in Fig. 10, the retort or steam process being most commonly used.

The retort shown in Fig. 10 is 28 inches wide, 32 inches high, and 10½ feet long, and will hold at one time 700 three-pound cans when arranged on the iron trays as shown in the illustration. The retort is provided with steam connections and a steam gauge for registering the steam pressure. Doors are located at each end and are provided with the usual tightening appliances. There is always a valve controlling the exhaust of the retort, as with some goods and in *boiling off* sealed cans the exhaust has to be kept open. The retort has a perforated steam-pipe fastened to the entire length of the bottom so as to distribute the steam equally throughout the box when processing.

Different materials are subjected to different pressures of steam and remain in the retort for different periods of time. The size of the cans also influences the time and pressure.

65. The object of processing, as mentioned before, is for complete and thorough sterilization as well as for additional cooking of the meat. At the expiration of the required time in the retort, the cans are removed on the trays and then in order to allow the air in them to escape, they are punctured. This operation is done as quickly as possible, the vents closed up, and the cans returned to the retort and heated again for a shorter or longer time, depending on the size of the can. This latter processing is technically termed *boiling off*.

Processing and boiling off under water with closed vents is also practiced extensively with satisfactory results and it is claimed by some that this method gives a better flavor to the canned product. In processing in the water bath, the time of process is taken from the time the water begins to boil. These process tanks, either of wood or iron, are 3 feet 10 inches long, 2 feet 10 inches wide, and 3 feet 6 inches deep. The cans are put into the process tanks on trays to facilitate handling in removing. The cans, when removed, are also punctured the same as in steam processing, sealed, and boiled off again in the water.

The calcium-chloride bath is also employed for processing and boiling off. A solution of this salt is made with water, which makes possible a temperature of 240° F. in the open bath, whereas the highest temperature obtainable in the ordinary open vat with water is 212° F. The final treatment of the cans after processing is the same in all three methods and will be described later.

66. In the **cold vacuum process,** the cans after being capped are first conducted by a belt conveyer to the soldering machine where the vent is closed. This machine is illustrated in Fig. 11.

The cans are placed in the machine through the door *A* and a vacuum is then made inside the machine. The machine is then revolved by hand and the cans are soldered with one turn of the machine. After this operation the door is opened and the cans are removed by one more turn of the revolving plate, which is operated by the turning wheel *B*. These vacuum sealing machines are equipped for either electric or gas soldering.

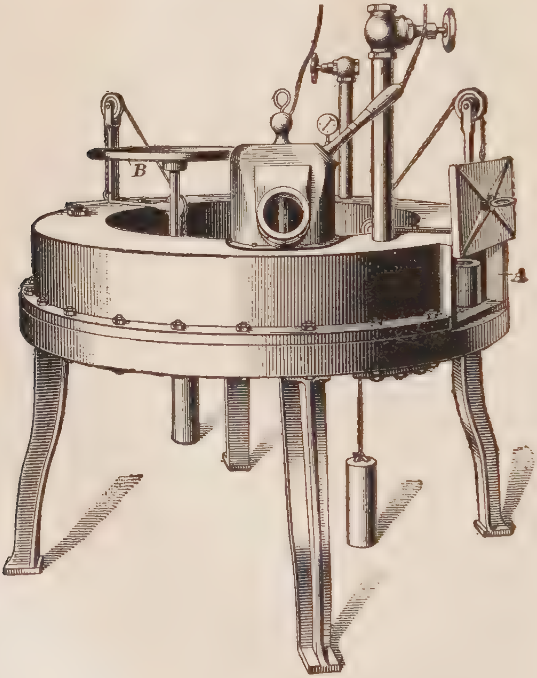

Fig. 11

After sealing, the cans enter the retort and steam under suitable pressure admitted. This pressure may vary from 2 to 12 pounds and the time of application from ½ hour to 12 hours, depending on the size of the can and the nature of its contents. The subsequent steps are common to all three methods.

67. In the **hot process**, after being packed and capped, with the vent hole open, the cans are passed through a steam box. The object of this procedure is to remove the air remaining in the container. The vent is immediately closed to prevent reentering of the air which hinders the processing as carried out in the foregoing method.

The final step in all three methods after removal from the retorts or process tanks for the last time consists in taking the cans to the shower room, where cold water is run on them until they are cool. This sudden chilling contracts the ends of the cans, making them slightly concave, which is the proper condition for canned goods. The cans to remove any grease or other accumulations are then sent through a washing trough by mechanical means. From the washing machine the cans go to the lacquering and labeling room where they are finished and made ready for packing and shipping.

68. The following specifications of the United States Navy are of interest in showing the care taken in the packing house in the preparation of food products:

CORNED BEEF, COOKED AND TINNED

Meat to be of the first quality cooked corned beef; no meat other than from the dressed carcasses of well-nourished cattle to be used. Meat to be strictly fresh and in prime condition. Head meat, scrap meat, and meat from shanks, flanks and skirts to be excluded. The finished product to be free from gristle, blood clots, excessive fats, and fatty connective tissue, and excessive jelly. To be of good flavor and free from objectionable odors. Upon analysis the finished product to show not more than 3¼ per cent. of common salt and not more than .2 per cent. saltpeter.

TINNED HAM

Shall be of the best quality boneless ham, full weight, in key-opening tins of 2 pounds each, weight of tins not included. Each tin to be marked with contents, name of contractor, name of packer, brand, and date of packing, and to be properly lacquered. Each dozen tins to be enclosed in a substantial box made of well-seasoned pine or spruce, properly nailed; sides to be $\frac{3}{4}''$ and ends $1''$ thick. Boxes to be marked on one end with contents, name of contractor, date of packing, and the stamp provided for inspected meats by the Secretary of Agriculture, and to be free from all other marks.

The contractor shall guarantee that the ham will keep good in any climate for 1 year from date of delivery.

TINNED BACON

To be dry salt-cured, cut from 10-pound average bellies when laid down; square cut, seedless; from light prime hogs in good condition; sweet and sound; a good streak of lean in each piece; not too fat; less than $2\frac{1}{2}''$ thick at shoulder end; well cured.

To be put up in flat, rectangular, key-opening cans (vacuum process) of 5 pounds net weight each; tins to be marked with contents, name of contractor, and date of packing, and to be properly lacquered; 2, or at most 3, pieces of bacon of about equal weights (no scraps) to be put up in each can; the contents of each can to be wrapped in vegetable parchment paper.

Tins to be enclosed in a substantial box, made of well-seasoned pine or spruce, properly nailed; the sides, tops, and bottoms to be made $\frac{3}{4}''$ thick, and the ends to be $1''$ thick, when finished; each box to contain 8 tins, and to be distinctly marked, on only one end, with contents (stating net weight), name of contractor, and date of packing. Each case must bear thereon the stamp provided for inspected meats by the Secretary of Agriculture. Cases must be free from advertising matter.

The contractor shall guarantee that the bacon will keep good in any climate for 1 year from date of delivery.

LARD

To be made from absolutely fresh-killed properly chilled hogs. To contain only body and leaf fat (no head, foot, or gut fat to be used). To be white in color, without bleaching, agitation, use of chemicals, or any other means of artificial coloring. To be thoroughly cooked by steam heat.

Lard to be chilled to a state of being liquid and then run into square tins of 5 pounds each, net. Tins to be hermetically sealed, with all seams soldered, and to be properly lacquered. Tins must be thoroughly cleaned before being packed into wooden cases. Each tin to be marked with contents, name of contractor, and date of packing.

The contractor must furnish free of charge, with each delivery, a certificate from a licensed produce-exchange inspector that the deliveries are what are required by the specifications in regard to quality of lard and packing.

The contractor shall guarantee that the lard will keep good in any climate for 1 year from the date of delivery.

To be packed in boxes made of planed white pine or spruce; tops, bottoms, and sides to be $\frac{7}{8}''$ thick; ends to be 1″ thick, when finished. All cases to be strapped with $\frac{1}{2}''$ flat iron, and distinctly marked, on one end only, with contents (giving net weight), name of contractor, and date of packing. Each case to contain 8 tins. Cases to be free from advertising matter.

BUTTERINE

69. Composition.—Butterine, or oleomargarine, is composed of oleo oil, cottonseed oil, peanut oil, coconut oil, genuine butter, and neutral lard, with a small proportion of moisture and salt, with or without coloring matter.

The manufacture of this product is carried on in packing houses where state statutes permit its manufacture. The highest grades of butterine have as much as 33 per cent. of genuine butter in their composition and others 25 per cent. This proportion may be and is varied at will by the different manufacturers. Each manufacturer has his individual formula, but as every factory in the United States is under direct government supervision, it is obvious that only materials of unquestioned healthfulness may be used.

Each factory is required to make a daily report of the exact quantity and kind of materials used and also the number of pounds of butterine produced from these materials. This report must be made under oath to government officials, and severe penalties are incurred for infractions of the regulations.

The manufacture is attended with the most scrupulous cleanliness not only as a matter of personal convenience, but as an essential in producing a merchantable article of trade, as without this cleanliness good butterine cannot be made.

A federal statute vitally affecting the manufacture of oleomargarine went into effect on July 1, 1902. This law imposes a tax of 10 cents per pound on oleomargarine, or butterine, used for domestic consumption, in which yellow coloring matter is introduced. The effect of this legislation has been to reduce considerably the number of establishments formerly engaged in the manufacture of this article. For uncolored oleomargarine, that is, butterine manufactured from the materials in their natural state and without being colored in imitation of butter, a federal tax of only ¼ cent per pound is imposed.

70. Ingredients Used.—As previously stated, the quality of the ingredients used in making butterine is of the highest. Their condition and preliminary treatment are as follows:

The milk used is received in cans surrounded by felt casings to protect it from changes in temperature. This milk is poured into the receiving vat from which it is pumped through a fine strainer to remove all impurities, into the pasteurizer. Here it is heated to a temperature of 180° F., ½ hour, whereby all germ life and objectionable flavor is destroyed.

The milk is then ripened, that is, it is caused to become sour or acquire acidity through the addition of certain lactic-acid-forming ferments. This process usually requires about 24 hours at a temperature of 60° to 70° F.

The neutral lard used for butterine does not have to be grained, as it is used in a liquid condition. The same applies with equal force to the oleo oil.

The cottonseed oil used is of the grade known as butter oil—the choicest grade of this material.

The peanut and coconut oils are highly refined and deodorized and are of the highest grade obtainable.

71. Churning and Finishing.—The churns used for producing butterine are fixed, upright, sheet-iron cylinders capable of holding a charge of about 600 pounds of mixed material. The churns are partly enclosed on the top with curved sheet iron and inside the churn are paddles fixed to a revolving shaft. When churning, this shaft with the paddles makes from 500 to 600 revolutions per minute.

The proportions of the different ingredients vary. The following proportions for 100 pounds of butterine are those used by a manufacturer who makes about 15 tons of butterine daily.

Cream sufficient to produce 15 pounds of butter; cottonseed oil, 15 pounds; neutral lard, 35 pounds; and oleo oil, 35 pounds. The proportion of butter color varies with the season and the trade; from ½ to 1 ounce per 100 pounds of butterine is the usual amount added. This is placed in the churn with the other ingredients at the time of churning when colored oleomargarine is desired. Otherwise, the process is carried out as described without the use of coloring matter.

The coloring matters that may be used at the present time in coloring butterine, are annatto (see *Organic Chemistry*) and the colors technically known as *Yellow A.B.* and *O.B.* These must be prepared according to the regulations of the United States Department of Agriculture.

72. The desired weights of the various ingredients are run into the churn and the mixture is churned by means of the revolving paddles for 6 or 7 minutes, when the operation is completed. The best temperature for churning is about 90° F., and the various ingredients are introduced into the churn at temperatures to obtain this. The oleo oil and neutral lard are run in at about 110° F., the cream at about 70° F., and the cottonseed oil at normal room temperature.

The butterine is now run from the bottom of the churn into tanks, or vats, of ice-cold water to produce the requisite butter grain. This water is kept cold by having a constant supply of ice in it. Some manufacturers place cakes of ice in the bottom of the vats over which the water flows constantly, thus maintaining a steady temperature of about 34° F. The churned product is allowed to remain in these vats with the water for about 10 minutes, or until it has acquired a firm set, when it is thrown by means of wooden shovels on inclined tables and permitted to drain. The temperature of this room is kept at 70° F. At this stage the butterine is salted with an amount varying with the requirements of the trade. From ½ to ¾ ounce of salt to 1 pound of butterine is sprinkled over the mass which during the 10-hour period of draining is turned over three or four times to allow the water to drain from it.

This is generally done at night so that the material is ready for working the next day, when the butterine is worked with the regulation butter worker, to press out the superfluous water and to distribute the salt evenly. Butterine is packed in regulation butter tubs, on every package of which is placed the usual revenue stamp and a penalty label. It is also made into pound prints resembling butter and wrapped similarly in parchment paper. Very little labor is attached to the making of butterine, a few employes being able to produce large quantities daily.

In the United States, the names *butterine* and *oleomargarine* are used synonymously. In Europe, however, oleomargarine is almost always termed *margarine*.

Within the last few years the manufacture of the so-called *nut margarine* has assumed rapidly increasing proportions. The name is due to the fact that it contains coconut and peanut oils to the exclusion of all other fats excepting those contained in the milk. The method of manufacture parallels that of the regular oleomargarine.

GLUE

73. Glues are now made in many packing houses from raw material that was at one time sold to glue manufacturers and from liquors that were formerly wasted. While perhaps not properly belonging to the packing industry, nevertheless a short account of the method of making glue will be given here.

The chief sources of glue in the packing house are the waters or liquors from the boiling of cattle and sheep heads, feet, and bones, and those from sinews, hide trimmings, horn piths, calves' heads, and pigs' feet. In making glue, a thorough knowledge of the raw material is necessary in order to produce good results. In this manufacture as in all others, poor material will never yield a high-grade, finished product. Material in prime condition if allowed to lie around in heaps or be subjected to incipient decomposition will very quickly become unfit for use as glue; or if used, will produce only low-grade, weak, and foul-smelling glues. To obtain good glues, it is necessary to have the stock in a sound, sweet condition.

74. Glue Stock.—The glue stock may be either green or dry, green-salted or dry-salted. Green stock consists of material in the fresh state, such as fresh hide pieces, sinews, calves' heads, feet, etc. Dry stock consists of glue-making material such as bones, etc., dried, without salting or other treatment. Green-salted material comprises fresh stock that has been cured by means of salt, such as pieces of salted hides, sinews, calves' trimmings, etc. Dry-salted goods consist of trimmings, etc., from South American hides, rawhides, etc.

75. In examining glue stock for utility, the examination should include, for dry and dry-salted stock, the gain in weight by soaking over night in water. This should be about 50 per cent. of their original weight and, in addition, the soaked pieces should be tough and of firm texture. The odor of both the soaked stock and the water should not be strong. If such is the case, the stock is moldy or the gelatinous matter has been destroyed by insects. The impurities, consisting of dirt and salt, should not exceed 5 or 6 per cent.

Green-salted stock should be examined for the purpose of determining whether it contains any decomposed, discolored, slimy, or heated pieces. The latter, if not in a state of decomposition, are bordering on it. The total amount of salt and moisture for this material should not exceed 40 per cent.

The bones in the packing house designed for glue should not be overcooked; that is, they should be smooth and hard and not have a chalky, white surface. The latter condition indicates that most of the glue has already been cooked out of them. Soft bones, such as rib bones, yield more glue than the hard bones of the legs and thighs. Bones that have been exposed to weather influences were formerly supposed to yield only little glue of poor quality, but by a recently devised secret process these bones may be made to yield an excellent light-colored glue.

Horn piths should be free from the skin covering and should not be discolored from drying on steam coils. If the tips of the piths are easily broken off, it shows that they have been subjected to a very high temperature and much of the gelatinous matter thereby destroyed.

Fresh glue stock presents no difficulties in the manufacture of glue; but care must be taken to keep it from becoming decomposed before using.

76. Bone Glue Liquor.—One of the chief products of the packing-house glue department is bone glue of which there are many qualities, varying from a fine white gelatine to dark-colored, low-grade glues. One method of preparing this product consists in cooking the bones in open vats and evaporating the resultant glue liquors to the desired density in the vacuum pan from which the liquors are run into the forms for cooling. As many cookings of bones for glue liquor are made as is practicable; that is, the bones are used as long as the liquors obtained contain sufficient glue to make evaporation profitable for forming the glue jelly.

Another method of producing glue liquors is by cooking the bones under pressure. The same principle is applied as in other cases; such, for example, as cooking the bones in tanks under a pressure of 10 or 15 pounds per square inch for two periods of 2 hours each. The yield of glue by this method is better than that obtained from cooking the bones in open vats. By the pressure method, from 11 to 14 per cent. of glue is obtained, while the open cooking yields only from 6 to 10 per cent. When cooking the bones in the tanks under pressure water sufficient to cover them must be added.

Bones are sometimes leached with acid to dissolve out the inorganic matter. For this purpose the bones should be as free as possible from grease and also tough and hard. The bones are covered with dilute hydrochloric acid. They remain covered generally from 3 to 4 weeks, depending on the size of the bones. The bones after this leaching are soft and spongy and have a rather strong odor. The material is then known as raw gelatine and is suitable for the best grades of bone glue and gelatines.

The glue liquors while hot are run to the settling tanks where they are allowed to settle and clarify. Any grease appearing on the surface is carefully removed as it is important to have all glues as free as possible from grease.

77. Horn-Pith Glues and Gelatines.—In using horn piths for making glues and gelatines, they are leached with hydrochloric acid of 2° Baumé or with phosphoric acid of 6° Baumé in vats having perforated false bottoms. When the horn pith can be cut through easily in any direction with a knife the leaching is finished. The horn piths are then drained free from acid which is replaced with clean, soft water until all traces of acid are removed. This material furnishes fine gelatines and glues on cooking. From 30 to 35 per cent. of raw gelatine may be obtained from dry horn piths; and from the dry, raw gelatine, about 90 per cent. of glue. When phosphoric acid is used for leaching from 6 to 8 weeks is required for leaching the horn piths.

78. Head Glue Liquor.—The glue liquors from cooking heads and feet previously described yield on evaporation light, yellowish-colored glues, closely approaching white. The liquor when drawn off from the cooking vats has a density of about 2° Baumé. It is allowed to clarify by settling and is then evaporated in the vacuum or other apparatus to the desired consistency when it is run into the jelly molds, cooled, cut, and dried in the usual way.

79. Clarification of Glues.—When glue liquors are made of sound stock they come from the cooking vats in a clear condition and, on standing a few hours in the settlers become easily clarified, any impurities rising to the top with the grease or settling at the bottom. The glue liquor after settling is tested for clearness and, when in a satisfactory condition, is evaporated either in the vacuum pan or other apparatus and run into forms for glue jelly.

The first runs of glue liquors in general are easy to manipulate, but the last runs containing the residual glue stock are usually muddy and contaminated with impurities. This class of material is most frequently made into colored glues by mixing zinc oxide with them, thus producing a good-looking, merchantable article.

It is necessary for glues to have an acid reaction in order to clarify by settling. Where a neutral or alkaline condition exists it is better to clarify by sprinkling a solution of alum into the glue solution. Albumin is used at times as a clarifying agent with good results. The glue liquor is cooled to about 140° F., when the solution of albumin is added and the whole stirred thoroughly and then heated just short of the boiling point. The albumin in coagulating entangles the impurities in the glue liquor and settles to the bottom. The addition of a small amount of ammonium chloride with the albumin makes the clarification more complete.

During recent years in the clarification of glues the filter press has been brought into use. If a decolorizing material such as bone black is mixed with the glue liquors on pumping the mixture through the filter press, a clear, brilliant, and somewhat bleached product is obtained. In many establishments this method has superseded the old way of allowing the glue to clarify itself by settling on account of the time saved and the reduced liability in warm weather of the warm glue liquors becoming sour, or decomposed, and thus rendered useless.

80. Bleaching Glue Liquors.—The bleaching of glue liquors is practiced a great deal by modern glue makers. Bones, before cooking, if covered with a 1-per-cent. solution of sulphurous acid for 24 hours, are bleached to a considerable extent. Such bones are washed free from acid and when boiled furnish a very light-colored glue.

A very common method of bleaching glue liquors is to pass washed sulphur-dioxide gas through them until the desired light color is obtained. This is the most common and the cheapest method of bleaching. Liquid sulphur dioxide is now manufactured for this purpose and is transported in heavy iron cylinders similar to those used for anhydrous ammonia. While the sulphur-dioxide method of bleaching is cheap, it cannot always be used with good results on very dark-colored glue liquor.

Other bleaching agents employed are zinc salts such as sulphate and chloride but, unless carefully used, their presence in the glue is liable to be very detrimental.

In Germany limed glue stock is treated with hydrochloric acid and chloride of lime for about ½ hour, after which it is thoroughly washed. If this treatment is continued too long, however, the stock will become hard and almost insoluble. The so-called Cologne glues, which are very light-colored, are said to be produced by this treatment.

Peroxide of hydrogen has been used for bleaching glues and answers the purpose well. It will almost instantly turn the darkest-brown glue liquors into a light-yellow color. The item of cost, however, has prevented this material from assuming commercial importance.

81. Preservatives Used in Glues.—Preservatives are frequently used in glues. Sulphur dioxide, in addition to bleaching glues, acts as a preservative for them. The preservatives most commonly employed are the zinc salts—the oxide, sulphate, or chloride. At the same time the sulphur dioxide has the additional advantage of producing a light-colored glue. Alum is also employed as a preservative, but it is liable to give a flaky appearance to the glues if used in too large quantities. Formaldehyde has recently been employed as a glue preservative. If, however, an excess over and above that necessary for preservative purposes is added to glue liquor, the glue will almost immediately be rendered insoluble.

82. Concentration of Glue Liquors.—Glue liquors may be concentrated by evaporating them in jacketed kettles, in evaporating vats provided with steam pipes, or by means of a revolving steam-heated drum similar to Fig. 7. With all these methods the evaporation takes place under ordinary atmospheric conditions. The results in many cases are very satisfactory, but all open evaporators have the disadvantage of subjecting the glue liquors to a high temperature which is very detrimental to the strength of the finished glue. With many of these evaporators the heated iron surface reaches a temperature of nearly 300° F., which naturally scorches the glue, forms a crust on the heated surface, and thus hinders rapid evaporation. The glues produced by open evaporators do not compare favorably in strength and color with those made of the same kind of material by evaporation in a vacuum apparatus.

The concentration of liquors in the vacuum apparatus is accomplished by producing a partial vacuum in the apparatus, thus partly removing the atmospheric pressure from the liquid therein. By exhausting the air and producing a vacuum of 8.7 pounds per square inch, as shown by the vacuum gauge, the liquor enclosed in the vacuum pan will boil at a temperature of 170.1° F. The lower the temperature at which any glue is made, the better will be its color and strength. This is especially true of high-grade glues.

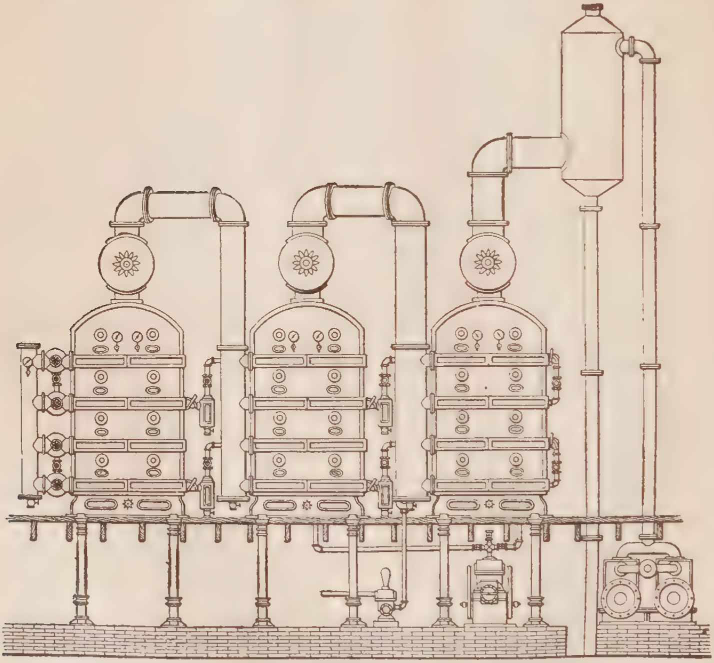

FIG. 12

83. Vacuum evaporators are operated either by direct steam or by exhaust steam from an engine. Another advantage in using this kind of apparatus is that less fuel is required for the evaporation of a given weight of water. In the ordinary vacuum pan, 1 pound of coal will evaporate upwards of 8 pounds of water, while with open evaporators, excellent use is made of the coal if 1 pound evaporates 6 pounds of water. With a vacuum pan of three *effects*, or chambers, an evaporation of 24 pounds of water is obtained from 1 pound of coal. The economical principle of the multiple-effect vacuum pan consists in utilizing the heat over and over again. The steam introduced into the tubes of the first effect evaporates a quantity of water and the steam thus formed passes into the tubes of the second effect. The steam produced by this evaporation passes into the third effect and evaporates still more water. It has been demonstrated, however, that more than four effects cannot be used satisfactorily. Fig. 12 shows a modern multiple-effect vacuum apparatus with three effects.

The single-effect vacuum pan is used where there are comparatively small quantities of liquor to be evaporated. But in the largest packing houses the multiple-effect vacuum pans are employed in concentrating glue liquors.

84. With either kind of apparatus, open or vacuum, the clarified glue liquors are evaporated to a thick consistency so that they will set to a firm jelly within 10 or 12 hours. The concentrated glue liquors are run from the evaporating apparatus into molds, or boxes, for forming the desired cake of jelly. These molds are usually made of galvanized iron and hold about 50 pounds of the glue liquor. They are made flaring so that the glue jelly may be easily emptied from them. Any desired shape may be used, as there is no general standard.

The boxes are filled to within ½ inch of the top and are allowed to set in a well-ventilated room protected from extremes of temperature until the jelly has become hard and firm. Some establishments set the boxes in a trough of cold, running water and allow them to be cooled in this way. Under no circumstances should the glue liquor be allowed to freeze or to remain too long in a moderately warm temperature. In the former case, the glue jelly will become so brittle that it cannot be cut, and in the latter, the liquor will decompose and become worthless. The jelly in the boxes, when firm and in condition to be handled, is ready for cutting into sheets.

A patented process for cooling, setting, and cutting the glue by a continuous operation is in use in one large factory. The glue liquor is chilled on a brine-cooled cylinder, which, revolving slowly, dips the lower part into the glue liquor and carries enough of this liquor on its surface to form within one revolution a thin layer of firm jelly. This can be wound off the cylinder as an endless ribbon, cut by the machine into suitable sizes, spread on frames, and sent to the drying room.

85. Cutting Glues.—The glue jelly is usually cut into sheets by wire machines although other kinds of cutting apparatus are used. The wire machines consist of frames of steel with wires set in such a way as to produce a slice of glue jelly of the desired thickness. In the old-style machine, the jelly is cut by movable wires; in the new style, the wires are stationary, being set in steel frames. These frames are about 2 feet from one another, in line, so that when the cake of jelly moves on an endless belt each wire in turn cuts a slice of jelly. For cutting low-grade glues a knife-cutting machine is used. The circular knives are set on a shaft and spaced sufficiently far apart to make the desired thickness of the sheet of jelly. With this machine the tops with the bubbles and the bottoms with the settlings are removed; later these are remelted with fresh material.

86. The sheets of glue after cutting are spread on nets of galvanized-iron wire having meshes of about 1 inch. These nets have a framework of wood that sets into another frame built on a truck. As fast as the nets are covered with sheets of glue they are placed on the truck. This truck when filled is run into the drying room where the glue remains until dry. Although perfectly dry to the touch, the glue ordinarily contains from 10 to 13 per cent. of moisture. Excessive drying of the glue is not desired by the manufacturers for obvious reasons.

In a heated chamber furnished with fans or blowers, the drying operation occupies at the present day only a few hours; whereas, formerly, by exposure in airy lofts, it took several days.

Sheets of glue that are imperfect or broken, if of cheap quality, may be made into ground glues by passing the material through a grinding mill. Where the glue is of high quality, imperfect sheets and pieces are remelted with the next batch of high-grade material. The lighter the glue—strength, clearness, etc., being equal—the better will be the price obtained for it.

87. Yields of Glue.—From green-salted hide trimmings, sinews, etc., from 18 to 20 per cent. of glue may be obtained. These materials when dry yield from 50 to 65 per cent., according to quality and condition. From hard, dry bones an average yield of 18 per cent. is obtained. From green rib bones—practically the only way this material is worked up for glue—an average yield of 12 per cent. of glue is obtained.

PACKING-HOUSE INDUSTRIES
(PART 3)

VARIOUS ANIMAL PRODUCTS AND THEIR DISPOSITION—(Continued)

CURED MEATS

1. The curing of the meat products of the packing house is such a wide subject that it cannot be treated in full here. The principle underlying the curing process in either the wet (pickle) or the dry (salt) way, is the prevention of putrefaction of the products by means of salt and other curative agents. Among the latter are saltpeter, wood smoke, vinegar, etc. Salt alone may be used but to obtain the best results for mild cures its harsh effect is toned down with sugar, sirup, or molasses. When these saccharine substances are used in conjunction with brine or dry-salt curing, the meats are termed sweet-pickled meats.

In connection with the curing and preserving of meats, the wholesomeness of any colors, preservatives, or other substances added to foods of any description in the packing houses, is determined by the Secretary of Agriculture, who promulgates the names of those substances which are permitted or inhibited in food products. The secretary also determines from time to time the principles that shall guide the use of colors, preservatives, etc., and the principles so established become a part of existing regulations. Where meats are to be exported, however, the use of preservatives is

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permitted under certain conditions (see *Packing-House Industries,* Part 1).

2. Dry-Salt Meats.—Meats that have been cured by covering with salt and piled about 6 feet high on the floor of the curing cellar are known as dry-salt meats. A small proportion of saltpeter is frequently mixed with the salt to give to the lean meat the ruddy appearance always desired. These cuts of meat are taken down and repiled three or four times during the period of curing. This operation is technically termed overhauling, the object being to allow the salt and brine made by the moisture in the meats to affect all parts of the cut equally. The time allowed for curing these articles in packing houses is based on 1 day per pound of the weight of the cut. The dry-salt method of curing is most largely and almost exclusively applied to pork products. Dry-salt meats are shipped for domestic trade in bulk, and for export trade, packed with borax in boxes.

3. Wet-Cured Meats.—Both pork and beef products are cured in brine or in pickle. The distinction between these terms is that the former is a solution of salt in water, while the latter is brine to which various permitted ingredients such as sugar and saltpeter have been added. The following cuts of meat are ordinarily cured by this process: pork hams and bacon before smoking; beef hams before drying; pork, beef, and sheep tongues before canning; and beef marketed as corned beef.

Each establishment has its own formula for making pickle and its own method of curing in this solution. The time required for curing meats in pickle varies according to many circumstances, such as the strength of the pickle (percentage of salt) and the size and nature of the cut. While a piece of bacon weighing 4 or 5 pounds may be cured in 21 days, a very large ham may require over 100 days. During the process all the pieces of meat are subject to frequent overhauling.

Small pieces of beef to be used for canning purposes are cured in 15 days, as their small size—4 to 6 pounds—permits them to be readily permeated by the pickle. Even then, as with all pickled meats, they require frequent disturbance or transfer from one vat to another to insure a uniformly cured product.

With the exception of hams, all meats are cured by simple immersion in the pickle or brine. The thickness of the ham, however, prevents the pickle from penetrating the meat before decomposition sets in. To overcome this difficulty, a long, hollow, nickel needle is pushed into the ham and the pickle forced through it by means of a pump and into the meat. The pickle is usually pumped into the ham at the stifle joint, the aitch bone, and in the shank. After being pumped the hams enter the curing vats where they receive the usual treatment as described. The pumping pickle is much stronger than the curing pickle, often consisting of a saturated salt solution containing varying amounts of sugar and nitrate. The curing pickle may contain 15 to 20 per cent. of salt with small amounts of sugar and nitrate.

4. Box-Cured Meats.—The better grades of bacon are dry-cured by what is known as the *box method*. The meats are first rubbed on both sides with a mixture of salt, saltpeter, and sugar. They are then packed rind side down in air-tight boxes. Each layer is firmly tamped into the box and spread over with more of the curing mixture. During the cure, which requires about 20 days, the lid is held firmly on the box by means of heavy weights. This method of curing is followed by the regular smoking.

5. Vinegar-Cured Meats.—Various small parts of the beef, sheep, and especially the hog, are cooked and pickled in vinegar and sold in this condition. Among the products handled in this way are beef tripe, pork and sheep tongues, pigs' feet, etc.

6. Smoked Meats.—Meats prepared by dry salt and vinegar cures are sold in this condition, while those handled in the other two ways are subjected to further treatment. Corned beef, and pork and beef tongues are generally canned, although beef tongues may be smoked. Beef hams are dried, forming the dried beef of commerce.

Whether the final process be canning, drying, or smoking, the meat is soaked in water, after coming from the curing vats, to remove the excess pickle. Hams, bacon, and some other cuts are subjected to smoking as a further means of assisting in the preservation of the products. The object of putting the meats into smoke is twofold—first, to evaporate a portion of the moisture of the meat and, second, to impregnate the products with creosote and other empyreumatic compounds, the latter giving to smoked meats their characteristic flavor.

7. The meats are hung in a smoke house; that is, an enclosed compartment at the bottom of which slow, smoldering fires are kept burning. Hardwoods and sawdust are used for fuel to produce the required smoke, as soft woods contain too much resinous matter which produces harmful effects on the meat.

The products remain in contact with the smoke for a period depending on many conditions, which are judged by personal observation. Among these are the depth of color desired, size of pieces, temperature, etc. A shrinkage of weight always takes place in this process, which depends also on circumstances; a general average of loss in weight may be taken as from 7 to 9 per cent.

The smoked products are removed from the smoke house and allowed to cool at the natural temperature of the room, when they are ready to be sold or packed for shipment.

BLOOD ALBUMIN

8. Preparation.—Blood albumin is one of the products made from the blood of slaughtered animals. The blood as it comes from the animal is caught in shallow pans, each being just large enough to hold the blood of one animal, or it is caught in pails and immediately poured into shallow pans with as little agitation as possible. The blood is then allowed to rest without stirring or agitation until it clots. It is an essential part of the process of manufacture that the blood should not be stirred, or it will be defibrinated and the proper separation cannot be made.

After clotting, the clot is scored into small squares with a sharp knife, and these pieces are placed in shallow pans with perforated bottoms through which the serum or albumin drains from the clot. It is better practice to place these pieces on a draining table arranged so that the serum runs into a trough.

The dark-red clot is used for the manufacture of ordinary dried blood. When separated from further impurities and dried under suitable conditions, the serum that drains through is the product that forms the dried albumen of commerce. The serum at this stage of the process is of a pinkish or light-red color which is due to the presence of some red corpuscles that have been imperfectly separated by clotting.

9. The next operation is to separate these red corpuscles, as the quality of the finished product depends on the perfection of this separation. The serum is placed in shallow pans which are about 3 feet long by 18 inches wide and 4 or 5 inches deep. At the center of the bottom of these pans is a perforated rubber stopper through which a ½-inch glass or lead tube extends until it reaches just above the surface of the liquid. The pans are filled with the serum and allowed to stand in a cool place for a few hours during which time the red corpuscles begin to sink. As the liquor clears at the top and the corpuscles sink lower and lower the tube is gradually lowered to draw off the clear serum into suitable vessels placed underneath, this operation being performed at intervals as long as the liquid runs off clear. When it is seen that further continued settling will not produce a clear liquid, the receptacle beneath the pan is changed and the liquid that afterwards comes over is used in making inferior grades of the product.

The serum that has drained off clear is of a very delicate pink color. It is placed in small, shallow, smooth enameled plates resembling ordinary pie plates, each of which holds about ½ pint. Previous to filling, the plates are slightly greased. The plates with the serum are then placed in a drying room and kept at a temperature of about 110° F. until the product dries. The dried albumin is then scraped off the plates, which operation is easily accomplished, as the film of grease prevents it from adhering. It is important that the temperature of the drying room be kept as low as possible and yet dry the product in a few hours. Otherwise there is danger of the serum coagulating and ruining the product.

The darker-colored albumin is dried in the same manner as the preceding. The first and best grade is a very clear and pale amber-colored product, its quality and value depending very much on its lightness of color. Blood albumin finds extensive use in the textile industries in printing cotton fabrics, or as a glue insoluble in water.

As liquid blood is a very perishable product, it is necessary that all the operations should be performed at a comparatively low temperature, about 38° to 40° F., to avoid decomposition and consequent inability to make albumin from the blood. It was customary formerly to manufacture the product only in winter, but with the modern system of artificial refrigeration it is possible to turn out a uniform product at all seasons.

In the very latest methods of manufacture the separation of the serum is accomplished by centrifugal machines, and the evaporation is subsequently conducted at a low temperature in a vacuum apparatus. Most of the product on the market, however, is still made by the old process, as the product produced by the centrifuge has not as good a color and the air-dried product is more soluble than the albumin made by the vacuum drier.

The yield of blood albumin from blood is theoretically 50 per cent., but this is never realized in practice. Five bullocks yield about 4½ gallons of serum which when dried gives 4½ pounds of albumin. The blood of twenty sheep or thirty-four calves gives the same quantity of blood albumin.

DIGESTIVE FERMENTS

10. All known digestive ferments belong to the class of soluble, or unorganized, ferments. They are sharply distinguished from the insoluble, or organized, ferments such as yeast, in not having the powers of self-nutrition and self-multiplication. In composition, digestive ferments resemble proteid substances, and contain carbon, hydrogen, oxygen, and nitrogen in somewhat similar proportions to albumin. None of these ferments has yet been obtained in a state of absolute purity. All digestive ferments are soluble in water and are diffusible, though with difficulty, through animal membranes and parchment paper. They are precipitated from their watery solutions by absolute alcohol, but, unlike other proteids, with the exception of peptone, they are not truly coagulated by alcohol. When the alcohol is removed the ferments are still found to be soluble in water and to retain their activity unimpaired. All digestive ferments are coagulated and rendered permanently inert by the heat of boiling water; and when in solution, they are coagulated and destroyed by a temperature of about 160° F.

The digestive ferments produced in the packing house are mainly pepsin and its products,. the former, however, being most commonly made.

11. Pepsin.—The mucous membrane of the stomachs of hogs is the chief source of pepsin, although the stomachs of other animals may be used. The large and steady supply of material from hogs makes it most conveniently available. The stomachs are emptied of their contents and thoroughly washed in cold water. Any food that clings to the mucous membrane is removed by hand. In the washing, violent, energetic motions should be avoided or a great deal of the pepsin-containing membrane is liable to be removed mechanically. Gentle handling is essential during the first stages of the preparation. The outsides of the stomachs are trimmed away.

That portion of the stomach reserved for the pepsin is chopped into small pieces and placed in water acidulated with from 3 to 4 per cent. of pure hydrochloric acid. The receptacle used for this purpose in the packing house is usually a large open hogshead. The material is allowed to remain in this weak acid solution and is kept at a temperature of 104° to 122° F. until it undergoes self-digestion. This operation is materially assisted by frequent stirring, but from 36 to 48 hours at least is required for the solution to be effected. At this stage of preparation, the liquid is very prone to decomposition and great watchfulness is required. An innocuous, antiseptic condition is occasioned by passing sulphur dioxide into the solution from a generator until the solution smells strongly of the gas. This operation also serves to bleach the product.

In this condition the liquid is allowed to stand and clarify itself by the precipitation of the mucus without causing any material injury to the pepsin from putrefactive changes. The resulting clear liquid is decanted or drawn off, and to it is then added common salt, the temperature of the liquid being maintained at 94° F. until complete separation of the pepsin results by precipitation. The pepsin thus obtained—the floating scum—when collected, pressed, and dried constitutes crude pepsin, which even in this form is marketable, being very active and meeting certain requirements of trade. The product has a faint but not disagreeable odor, a brownish-yellow color, and a slightly saline taste.

Another method is to evaporate the settled liquid in a vacuum pan at a temperature not above 105° F., and separate the salt and peptones by dialysis. This method does not require the use of sulphur dioxide.

12. Purified Pepsin.—The crude pepsin, preferably but not necessarily in the moist state, is dissolved again in weak hydrochloric acid and the solution thus obtained is subjected to dialysis by any suitable means until the salt has been eliminated from the pepsin solution. The purified liquor is then concentrated, preferably in vacuum apparatus, care being exercised not to have the heat exceed 100° or 105° F. The concentrated solution is then dried on glass plates the edges of which are raised to hold it. These plates are about 15 inches wide and 20 inches long, with the projecting edge $\frac{1}{4}$ inch high. The thin layer on the plates is dried as rapidly as possible in a drying room that is arranged with shelves to hold a number of plates. The temperature should not exceed 102° F. in this room, which must be well protected from dust. When thoroughly dry the pepsin (now the so-called pure pepsin of trade known as *scale pepsin*) is scraped from the glass plates. It will have a digestive power of about 1 to 3,000—that is, 1 part of pepsin will digest 3,000 parts of freshly coagulated egg albumin—if the operation has been properly performed. By further redissolving and dialyzing, the digestive power may be greatly increased, but ordinarily the price obtained is not commensurate with the labor and expense involved. The preceding strength—1 to 3,000—is the standard requirement for pharmaceutical and medical purposes.

13. Powdered Pepsin.—The scale pepsin made by the foregoing process is ground in any suitable mill in which the material is protected from the atmosphere during the process of grinding. This is necessary as the scale of pepsin is so hygroscopic in its nature that attempts to powder it without this precaution will prove futile. Several suitable mills, readily available and very serviceable for this purpose, are on the market. Powdered pepsin is made into pills, tablets, etc., and has the same digestive power as the scale pepsin from which it is made.

The compound preparations of pepsin enter into the field of the pharmacist rather than that of the chemist and will not be treated here.

14. Yield of Pepsin.—The yield of pepsin varies with the class of hog stomachs used. From a test of 3,318 pounds of membranes, trimmed for pepsin making, a yield of 117 pounds of high-grade pepsin was obtained. The weight of membranes from 250 whole hog stomachs was 200 pounds, thus giving a yield of 2.8 pounds of pepsin for each 100 stomachs. Another test from 9,000 stomachs gave a yield of 162 pounds, or 1.8 pounds of pepsin for each 100 stomachs.

The labor attached to the manufacture of pepsin is very slight. Ordinarily, one pepsin maker, with a boy, accomplishes the entire manufacture at a comparatively small cost.

Pepsin in a dry form, in common with all digestive ferments, permanently retains its properties. Moisture and heat are favorable to its decomposition and it is essential that it should be so prepared as to have peptone and all other substances of hygroscopic properties eliminated as completely as possible. Digestive ferments remain inert, and are not injured in the least by a low temperature. Pepsin exerts its activity in acid solutions only, while pancreatin acts best in neutral or alkaline solutions.

15. Valuation of Pepsin.—The chemist is frequently called upon to determine whether pepsin meets the requirements of the standard strength. The most approved method for the testing of pepsin is that officially given in the ninth decennial revision of the pharmacopœia of the United States of America. The method is as follows:

Mix 25 mils* of normal hydrochloric acid with 275 mils of distilled water and dissolve .1 gram of pepsin in 150 mils of this liquid. Immerse a hen's egg, which is not less than 5 nor more than 12 days old and has been kept in a cool place, in boiling water for 15 minutes. As soon as the egg has been sufficiently cooled to handle it, remove the pellicle and all of the yolk; at once rub the albumen through a clean, dry, hair or brass No. 40 sieve, reject the first portion that passes through the sieve, and place 10 grams of the succeeding portion in a wide-mouthed bottle of 100 mils capacity. Immediately add 2 mils of the acid liquid and, with the aid of a rubber-tipped glass rod, moisten the albumen uniformly. Again add 2 mils of the acid liquid, repeat the manipulation with the glass rod, and with gradually increasing portions of the acid liquid, until the total amount added measures 20 mils. Thoroughly separate the particles of albumen from each other, rinse the rod with 15 mils more of the acid liquid, and, after warming the mixture to 52° C., add exactly 5 mils of the solution of pepsin.

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*One mil is the equivalent of 1 cubic centimeter.

At once cork the bottle securely, invert it three times, and place in a water bath that has previously been regulated to maintain a temperature of 52° C. Keep it at this temperature for 2½ hours, agitating the contents every 10 minutes by inverting the bottle once. Then remove it from the water bath, pour the contents into a conical measure having a diameter not exceeding 1 centimeter at the bottom, and transfer the undigested egg albumen which adheres to the sides of the bottle, to the measure, with the aid of small portions of distilled water, until the total amount used measures 50 mils. Stir the mixture well and let it stand for ½ hour; the deposit of undissolved albumen does not then measure more than 1 mil. The relative proteolytic power of pepsin, stronger or weaker than that just described, may be determined by ascertaining by repeated trials the quantity of the pepsin solution, made as directed in the assay, required to digest, under the prescribed conditions, 10 grams of boiled and disintegrated egg albumen. To ascertain how many parts of egg albumen 1 part of pepsin will digest, divide 15,000 by this quantity expressed in mils.

16. Apparatus for Making Pepsin.—The necessary apparatus for manufacturing pepsin and compound preparations of it includes the following:

Mill, sifter, or bolter, percolators, funnels, glass plates for drying, glazed stone jars, the necessary hogsheads, barrels, etc.

For making the pepsin tablets, pepsin glycerol, essence, wine, and aromatic pepsin, a hot-water bath, hot-water funnel, and several glass bottles and funnels are necessary, in addition to the tablet machine.

17. Peptone.—By allowing the solution from which the pepsin precipitate has been removed to cool gradually, the salt will crystallize out. This solution contains practically all the peptones, and after the salt has crystallized from it the peptones are left in solution from which they may be obtained by evaporation and drying. There is a limited market for this product, however, and it is not manufactured extensively. The physiological characteristics are made use of to a much greater extent in other compounds, such as beef peptone.

18. Beef Peptone.—The compound known as beef peptone is made by digesting beef with the pancreas of the beef. The tougher and leaner the beef, the better will be the yield of beef peptone. The meat is very finely minced and to 25 parts are added 8 parts of the pancreas and 4 parts of water. The whole is allowed to digest in a jacketed kettle at a temperature not exceeding 130° F., for 6 hours, after which all the solids will, through a true digestive process, have passed into solution. During this time the mixture must be frequently stirred to facilitate the action. The solution is filtered through cotton-flannel bags in the same manner as beef extract and the filtrate is bleached the same as pepsin solution for which purpose the same apparatus will serve.

The bleached solution is evaporated to dryness on a water bath or at a temperature not exceeding 212° F. It may also be economically evaporated to a thick consistency in a vacuum apparatus and afterwards dried. The yield of beef peptone from this process, using tough and lean meat, is 13 to 14 per cent. of the total weight of the meat and pancreas. This yield is rather high for the ordinary run of beef, from which a yield of about 10 per cent. should be obtained.

19. Pancreatin.—The product known as pancreatin is a digestive ferment existing in the fluids of the pancreas, or sweetbreads, of animals. Pancreatin is ordinarily made from the pancreas of the hog, in a similar or analogous manner to that of pepsin from hog stomachs. This product is not made to any extent in the average packing house as it borders on the field of the pharmacist.

The pancreatin solution, like the pepsin, is also very susceptible to decomposition, which may be and usually is prevented by the addition to the solution of an infinitesimal amount of thymol or chloroform, either of which does not interfere with the action of the ferment. Ordinarily a dry defatted pancreas product is manufactured and is as satisfactory as the extract.

20. Rennet.—The fourth, or true, digestive stomach of the calf is utilized in preparing rennet. This product is not prepared in the packing house, the stomach being simply fresh frozen and sold in that condition.

A crude rennet may be prepared by simply trimming the calf stomach free from fat, etc., drying it at a low temperature, and then grinding it to a fine condition. The ground material is packed tightly in a glass or tin percolator, and any remaining fat (which would become rancid through oxidation) is extracted by means of low boiling petroleum, ether, etc. The fat-free, crude rennet is afterwards spread thinly and then heated gently to drive off the odor of the solvent.

Commercial rennet is prepared in almost the same manner as pepsin. The washed and cleaned tissue is cut into small pieces and allowed to self-digest in a 2 to 3 per cent. cold hydrochloric-acid solution for 2 days. The undigested matter is strained off and the liquid saturated with common salt. The rennet which separates is collected and dried, and constitutes the crude rennet of commerce. This must comply with the definition and tests of the National Formulary, which are as follows:

Rennet is a partially purified milk-curdling enzyme obtained from the glandular stomach of the calf, and is capable of coagulating not less than 25,000 times its weight of fresh milk. Rennet of a higher coagulating power may be brought to the standard by admixture with sodium chloride and sugar of milk.

Assay.—Mix .10 gram of rennet with 50 mils of distilled water by stirring (vigorous shaking or violent agitation of this liquid must be avoided). Allow the liquid to stand for exactly 15 minutes. Place 50 mils of cow's milk in a beaker about 12 centimeters in height and 5 centimeters in width. Warm rapidly on a water bath to 43° C., add 1 mil of the rennet solution and stir the mixture slowly for 10 seconds. Maintain the temperature of the bath of the rennet solution at 43° C. for 10 minutes, remove the beaker from the bath and tip it at an angle of 45°. The milk will by this time have lost its fluidity to the extent of exhibiting a decidedly convex surface. An additional 30 seconds on the water bath produces a firm curd.

ANIMAL EXTRACTS

21. Method of Manufacture.—Animal extracts are made from various organs and tissues of slaughtered animals. Modern medicine has recognized many of these as having great curative value. Some of the larger packing companies have established special laboratories for their manufacture while others sell raw products to pharmaceutical houses making a specialty of these products. The present-day methods of preparation are very largely trade secrets.

Of these animal extracts the most important are: pituitary extracts made from the pituitary bodies located at the base of the brain; the suprenal extracts made from suprenal glands located above the kidney; thyroid extracts from the thyroid gland located in the throat. While these three extracts are perhaps the most important, there are a great many others of value made from other organs or tissues. Among these are the spinal cord and brain substance, ovarian substance from the ovaries of cattle and hogs, and many others. Although details of making most of these substances are secret, the animal extracts are usually made by very carefully drying the substance, removing the fat, and then preparing the substance in powder form.

The control and standardization of these preparations is a very difficult and delicate matter and requires the work of a highly trained physiological chemist and one who is familiar with the latest literature and methods. The tendency at the present time is toward manufacturing the extracts at the large packing centers because of the fact that it is very desirable to handle these substances while fresh. It is very probable that in the future this will become an important branch of the packing industry.

TANKAGES AND FERTILIZERS

22. Tankage.—In the packing house there is always more or less material which is unfit for human consumption. At one time this waste material of the packing house was not only a nuisance, but the disposal of it was a source of expense. Now, however, all refuse is utilized by making it into the various grades of tankage, which are a source of income of no inconsiderable importance. These tankages are either used as stock foods or enter into the manufacture of fertilizers. These stock foods are sold on a guarantee to contain not less than 60 per cent. of protein. The content of fat, carbohydrate, and crude fiber is also guaranteed. The use of tankage as a fertilizer material will be described later.

The name properly applied to the sediment remaining in the tanks where meat scrap, with some bone, is rendered to separate the fat is tankage. The name is also applied to the refuse from tanking garbage, the dried product being known as garbage tankage. This product, however, is never made in packing houses. The name tankage is also loosely applied to mixtures that consist largely of bone and do not differ greatly in composition from pure bone.

After material has been cooked in the rendering tanks the fat is withdrawn from it, and when all that can be taken from the tank has been obtained, the cooked, hot, material is allowed to drop into a box or vat located in front and underneath the tank. Here the material is kept hot by steam pipes in the vat, and whatever grease or fat rises to the surface is skimmed off. The latter is technically known as skimmings, and is recooked with the next charge of fresh material.

The water with which the material in the tank has been cooked becomes impregnated with more or less fat and also with a very large quantity of nitrogenous material. It is technically known as tank water and is the source of concentrated tankage, or stick. The treatment of tank water will be described later under the heading Concentrated Tankage.

The material in the vat after skimming is drained free from the tank water, and while still hot is placed in the tankage or fertilizer press. This operation is ordinarily performed by hand, but in the modern establishments the tankage is made to flow from above into the press cloth on the forms that are placed on the platform of the press.

23. Pressing Tankage.—There are several forms of fertilizer presses in use. Among these are the knuckle-joint, the power-screw, and the hydraulic press. Fig. 1 shows the power-screw press, which is the style of fertilizer press preferred by many of the leading packers, and only by the use of this or similar presses have they been able to handle the immense amount of material that is now utilized and made into valuable fertilizer. This press has the advantage of giving the same pressure at every point, thus pressing a small amount of material as well as a large amount without the handling of any blocking. It is made very heavy and strong

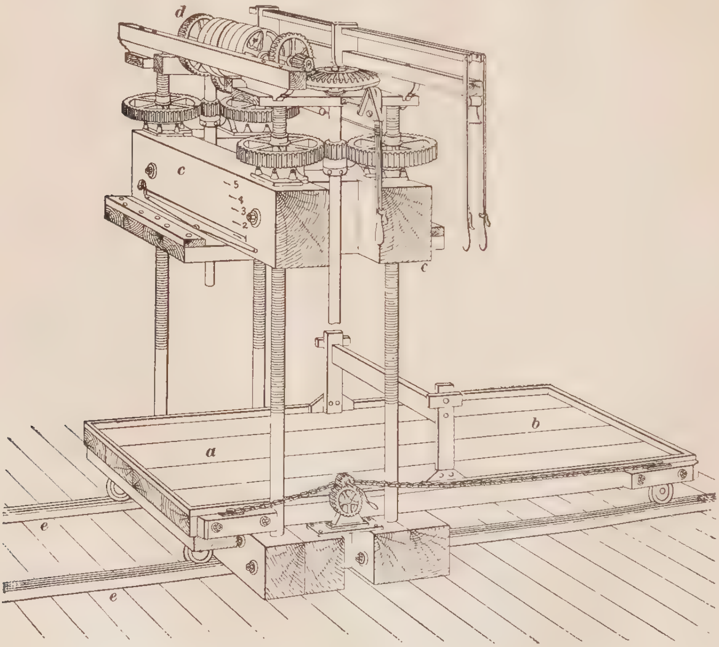
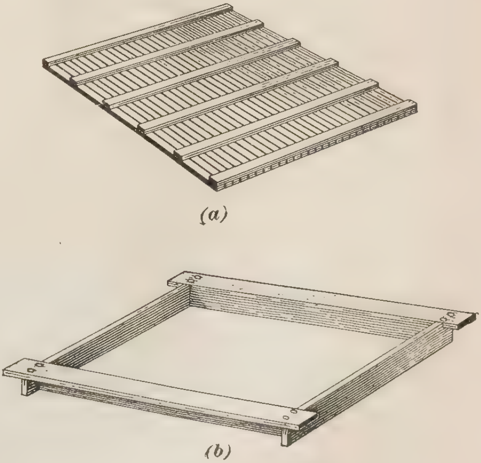


Fig. 1

to stand rough usage and will give an immense pressure. Although shown with a double platform, it may be fitted with any other style of platform to suit the situation.

24. The cloth used for pressing tankage is made especially for this purpose. It is known as tankage press cloth, and is made of rather coarsely, but strongly, woven jute. A rack, Fig. 2 (*a*), is first placed on the platform *a* of the press. This rack is square and is made of wooden strips $\frac{3}{8}$ inch thick by $\frac{7}{8}$ or $1\frac{3}{8}$ inches wide. These strips are placed $\frac{1}{4}$ inch apart, with five or more elm strips 2 inches wide and $\frac{3}{8}$ inch thick nailed across. Wrought-iron nails of sufficient length to clinch securely in the elm are used.


(*a*)

(*b*)

FIG. 2

25. The platforms *a* and *b*, which run on a track, may be filled at any convenient place and afterwards run to the press. On the rack is placed a form like that shown in Fig. 2 (*b*). This form is square inside and $3\frac{1}{2}$ inches deep. It is made by nailing together boards 1 inch thick by $3\frac{1}{2}$ inches wide, in the form of the sides of a box. A board is then nailed across each end, as shown, to serve as a guide and to give stiffness. Over this form is spread a cloth which is filled with tankage until the material is even with the top of the form. The cloths should be sufficiently large to enable the sides and ends to be folded over, thus completely covering the material. The form is then raised and another rack is placed on the layer thus made, the form being placed on this new rack, a cloth again placed over it, and another layer of wet tankage put in as before. From eight to twelve racks are used in one load and as many cloths less one. When the last layer is made, the form is taken off and a rack is placed on top of the load. The platform is then run on the track *e* to the press, and the pressing begins. By placing the racks alternately across and lengthwise of the platform, the built-up load will be less liable to move or to cant over and thus cause the racks to spread. A guide should be used in building the layers, so that the form will always be directly over the last layer. The load consisting of the different layers of material to be pressed is sometimes termed a *cheese*.

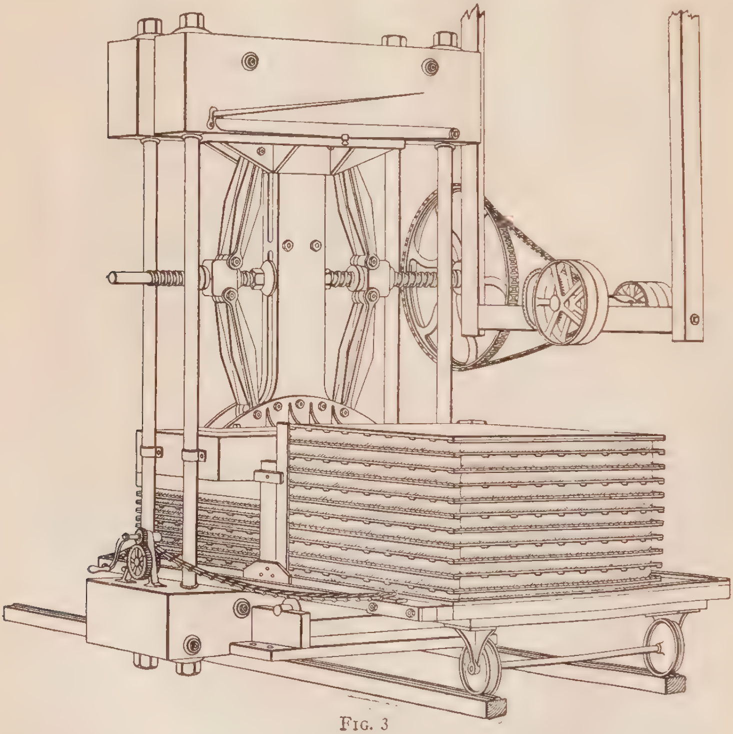


FIG. 3

26. The power in pressing is applied by the pulleys *d*, which cause the gears to move the upper part *c* of the press downwards, thereby pressing out the water and grease remaining in the wet tankage. The racks afford channels for this water and grease to run out of each layer. By a reverse motion of the power the upper part of the press is raised when the pressing is finished.

The advantage of the double platform is that while one load is being pressed on one side *a*, another may be built on the other side *b*.

27. In Fig. 3 is shown the knuckle-joint fertilizer press with one load pressing and another load of material in layers ready for running under the press when the first pressing is finished. The press is shown with double platform and power attachment, although if desired presses with single platform and hand-power attachment can be procured. For small packing houses this press has been found very satisfactory.

28. In using hydraulic presses for tankage, it is necessary to block the load by placing square pieces of wood between the load of layers and the upright guides on the press. The hydraulic press does excellent and rapid work and presses the material very much drier than either of the presses illustrated.

The pressed material contains approximately 50 per cent. of moisture after being removed from the press and shaken free from the cloths. The water and grease pressed out of the hot tankage run to a catch basin, where the grease rising to the top is skimmed off and recooked with refuse material for No. 2 tallow, or for yellow grease.

29. Drying the Pressed Tankage.—The pressed material is now transferred to the drier for the final drying into a commercial product. Several forms of driers may be had. Fig. 4 shows one of the most modern makes known as a single-cylinder drier. It is extremely simple in operation. The iron cylinder *A* is a jacketed, or double, shell in which are revolving arms, or paddles, operated by the shaft *b*. The fertilizer material to be dried is loaded into the cylinder through the door *c*, which is then closed, and the shaft is started revolving by the large cog wheel *f* operated by the power applied to the pulley *e*. Steam under pressure circulates through the double shell and

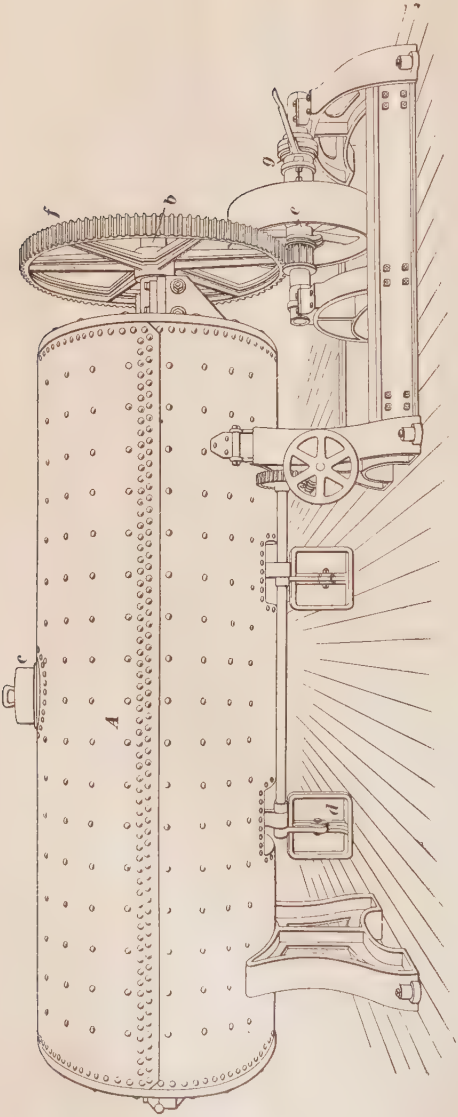


Fig. 4

the heat from it drives off the moisture in the material. The odors and gases coming from the fertilizer material pass through the pipes to the condenser which is attached to all driers. The condenser has jets of water running into it which, coming in contact with the hot gases, cool them and at the same time cause the greater part of them to pass into solution with the water. The cylinders of the drier vary from 3 to 5 feet in diameter and are from 10 to 16 feet long. The clutch *g* serves to start and stop the power that operates the drier.

The tankage is dried so that it contains 10 per cent. or less of moisture. This operation requires from 3 to 6 hours depending on the class and quantity of material worked on. It is then allowed to drop out through the doors *d*.

The material is so hot that if it were piled up in this condition it would not become cold and would rapidly decompose. The hot material, therefore, is spread on the floor about 3 inches deep. After the heat has gone from it the material is shoveled into piles; or if desired for immediate shipment, it is put into second-hand bags, such as salt bags, that will hold about 200 pounds each of the dried tankage.

Where the Wannenwetsch system (see *Packing-House Industries,* Part 1) of rendering is employed it is not necessary to use any press or drier for producing the finished tankage.

30. Small renderers frequently use a drier in the form of a steam-jacketed drum that is about 6 or 8 feet in diameter and about 2½ feet in height. This drum is provided on the inside with revolving or circulating arms for the purpose of preventing the material from sticking to the sides and also to facilitate the removal of the moisture. After the tankage is dried the door in the side is opened, permitting the revolving arms to empty the drier automatically. These driers are built to withstand a steam pressure of 75 pounds per square inch.

31. Grading of Tankage.—Tankage is divided into several grades, which are quoted by the percentages of ammonia and phosphoric acid shown by analysis. For example, a 7–30 tankage would be one that analyzes 7 per cent. of ammonia and 30 per cent. of phosphoric acid. Low-grade tankage contains less than 10 per cent. of ammonia and a high percentage of bone phosphate, while high-grade tankage always contains 10 per cent. or more of ammonia, and correspondingly less bone phosphate. Bone tankage, as the name implies, is that containing mostly bone.

Tankage is also classed as unground, crushed, and ground tankage. The former is tankage that is dried without subsequent grinding or crushing of large sinews, meaty pieces, or bones. Crushed tankage consists of unground tankage broken up sufficiently to pass through a screen of about 1- or 1½-inch mesh. Ground tankage is tankage ground to a fine condition. This material will pass through a sieve of about ½-inch mesh and constitutes the most valuable unfinished tankage. Tankages which are sold as animal foods are ground much finer so that they will pass through a 10-mesh sieve. These are the most valuable of all tankages.

Tankage is always valued on the percentage of both ammonia (nitrogen) and phosphoric acid contained in it, the former being always the most valuable component.

32. Concentrated Tankage.—In order to make concentrated tankage, also known under the trade name *stick,* the tank water from the cooking of meaty material is evaporated. Tank water contains a considerable amount of dissolved nitrogenous matter, which, when recovered in the form of concentrated tankage, furnishes a valuable fertilizer material.

The tank water is run to receivers and thence to evaporators where it is evaporated to a sirupy consistency. The mixture is concentrated to about 30 per cent. of moisture, when it is placed about 1 inch deep in sheet-iron pans that are 30 inches long, 15 inches wide, and 3 inches high. These are placed in a drying oven and the mixture is baked to dryness. The material is then knocked from the pans and ground fine. The product resembles ground blood and will analyze about 15 to 16 per cent. of ammonia on a dry basis. This material, like dry blood, is sold by the unit value, being quoted commercially at a certain price per unit. The unit is simply an arbitrary commercial standard, the chemical percentage of ammonia being taken. One per cent. of ammonia equals 1 unit per ton. When large quantities of concentrated tankage are treated, the form of evaporator used is the vacuum pan, which evaporates such quantities in an economical manner. Where small quantities are to be evaporated, the roller evaporator, similar to Fig. 7, *Packing-House Industries,* Part 2, may be used effectively.

33. Ground Blood.—In order to produce ground blood, the liquid blood is conducted from the slaughtered animals into a tank, or vat, where it is boiled with open steam for 20 minutes. This coagulates the albuminous matters and renders them practically insoluble. The clotted blood is then pressed precisely the same as tankage. The pressed-out water is of no value and is allowed to go to waste. The cloth for pressing blood is of closer texture but of the same material as tankage cloth.

The pressed blood from the fertilizer press contains about 50 per cent. of moisture. It is broken into small pieces and passed through a disintegrator which tears it into shreds about the size of a bean. The blood in this condition is then passed to the drier from which it emerges as dried blood containing, however, numerous hard lumps technically known as blood screenings. The blood is screened through a sieve and the screenings are ground by themselves to the required degree of fineness, and mixed with screened blood. Instead of sifting the dried blood as it comes from the drier, as is done in the large establishments, it may all be put through the mill and ground fine. The hot material is spread on the floor in a thin layer to allow the heat to escape, after which it is made into a pile or sacked like tankage.

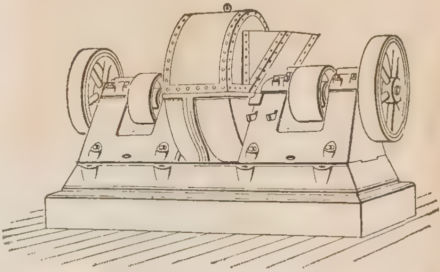


FIG. 5

Ground blood is always sold on the unit basis of the ammonia it contains, the percentage of which will vary according to its freedom from extraneous material and moisture. Clean ground blood should contain from 16 to 17 per cent. of ammonia and from 8 to 19 per cent. of moisture. When mixed with refuse, it may not contain over 9 per cent. of ammonia.

Where the amount of blood in comparison with the tankage is small, it is usually cooked along with the tankage. The resulting fertilizer is sold on the basis of its ingredients.

34. Raw Bone and Raw-Bone Meal.—The bones that have not been subjected to pressure in cooking, such as shin, knuckle, jaw, and head bones, furnish raw bone. After these have been freed from grease as much as possible and dried, they are ground finely in a bone mill, making raw-bone meal. This mill is sometimes termed a disintegrator. In Fig. 5 the disintegrator is shown closed and in Fig. 6 it is shown open. A peculiarity of the bone mill is that the material is ground by impact on rounded iron bars and on itself. The open machine shows the revolving barred wheels. The inside wheel *a* revolves in the opposite direction from the outside one *b*, and both revolve at a very high rate of speed. As the bones are fed into the hopper the revolving wheels keep them flying around until they are in a fine, dusty condition, when they pass through the bottom of the mill. The material is screened and any pieces of bone that have escaped grinding are returned to the mill. If the grinding is carefully done, this, however, is seldom necessary.

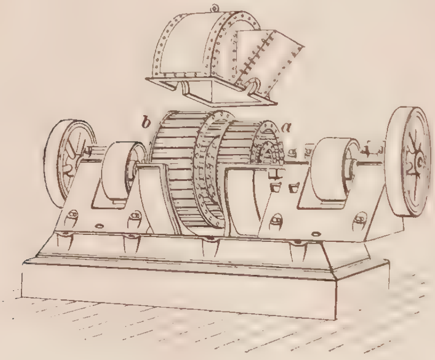


FIG. 6

After cooking, raw bone contains so much of the original substance that it is necessary, previous to grinding, to crush the bone by means of a bone crusher which is built on a plan similar to the ordinary rock or ore crusher. Raw-bone meal as produced in the packing house usually contains from 4 to 5½ per cent. of ammonia and from 20 to 25 per cent. of phosphoric acid.

35. Steamed Bone and Ground Steamed Bone. Bones that have been cooked under pressure are used for making steamed bone and ground steamed bone. All bones that are neither useful nor desirable for other purposes are made into steamed bone. They comprise rib bones, large knuckles, back bones, etc. From these bones are produced tallow and glue liquors. For producing the latter, in connection with steamed bone, special cooking of the bones is necessary. When the bones are simply cooked for the tallow and residual bone, however, no special cooking is required.

36. Cooking Bones for the Recovery of Tallow and Steamed Bone.—In order to recover tallow and steamed bone the bones are put into the rendering tank and cooked from 7 to 10 hours at a steam pressure of about 40 pounds per square inch, which effectually removes the tallow from the bones. After a period of rest to allow the tallow to rise, it is drawn off and the bones and water are dumped into a vat from which any floating tallow remaining is removed. The water is evaporated to concentrated tankage if it contains sufficient nitrogenous matter to make it profitable. The cooked bones are very friable and porous. After draining on the floor for several hours the bones are removed and placed in piles. The heat generated in these piles is amply sufficient to dry the bones without passing them through a drier.

37. Cooking Bones for the Recovery of Tallow, Glue Liquors, and Steamed Bone.—The method of cooking bones for the production of glue liquors, together with the tallow, is carried out as follows:

The bones, which are loaded into a tank, are allowed to stand in water at a temperature of about 130° F. for 1 hour. This water is run off and, where beef extract is made, is used for this purpose. The bones are again covered with water and cooked for 6 hours with the tank uncovered. This is known as open cooking. The material is allowed to settle, and the resultant tallow is drawn off. The cover is now put on the tank and the bones are cooked for 2 hours under a pressure of 30 pounds per square inch. The glue liquor after settling is drawn off, more water is put on the bones and a further pressure cooking of 3 hours is given, after which the tallow and glue liquor are drawn off. The material is now cooked at a pressure of 40 pounds per square inch for a few hours when, after drawing off the tallow, the cooked bones are dumped from the tank into the vat underneath and treated as described.

38. In Table I the results of tests on the boiling of rib bones are given. In test No. 1 the bones were boiled for the recovery of bone and tallow, and in test No. 2 the same material was boiled for the recovery of bone, tallow, and glue.

TABLE I

RESULTS OF TESTS ON BOILING RIB BONES

Test	Dry Glue Per Cent.	Tallow Per Cent.	Dry, Steamed Bone Per Cent.
No. 1	11.50	7.48	40.80
No. 2	21.27	10.88	31.64

In Table II are given the partial compositions of analyses of the dry, steamed bone obtained in the preceding tests.

While the cooking for glue by this method consumes more time and is more laborious, the increased yield in the tallow obtained together with the value of the glue liquor makes it a more profitable method than cooking the bones for tallow and bones only.

The average steamed bone will analyze from 2 to 3 per cent. of ammonia and about 60 per cent. of bone phosphate. The dried, steamed bone is made into steamed-bone meal by grinding in the ordinary bone mill. For this purpose the bones need not be previously crushed, as their brittle nature permits them to be very easily broken up.

TABLE II

PARTIAL COMPOSITIONS OF DRY, STEAMED BONE

Test	Ammonia Per Cent.	Bone Phosphate Per Cent.	Fat Per Cent.
No. 1	3.66	59.21	7.67
No. 2	1.45	72.01	2.33

39. Azotine.—The material known as azotine is made from the residue of cooked cracklings which, after being subjected to high pressure to extract all the grease possible, is passed through a drier and then finely ground. The material will shrink in weight from 35 to 40 per cent. in passing from the raw to the finished state and loses at the same time several per cent. of ammonia. This material is not made in the large packing houses, but is derived mostly from small tallow and grease renderers. Azotine is sold on the unit basis of the ammonia it contains, that made from pork material containing about 2 per cent. more ammonia than that made from beef. Commercial azotine will analyze about 15 per cent. of ammonia on a basis of 10 per cent. moisture.

40. Hoof Meal.—Cattle hoofs are used for making hoof meal. The hoofs are cooked in the pressure tank for 5 hours at a pressure of about 40 pounds of steam per square inch, after which they are dried thoroughly. Care must be taken to have the cooked hoofs perfectly dry, for if they contain any appreciable moisture it will be impossible to grind them. The dried hoofs are ground in the regulation bone-grinding mill to the fineness of bone meal. With the hoofs may also be placed useless horns which also furnish hoof meal when ground. This material contains a large amount of nitrogen, analyzing on a dry basis over 19 per cent. of ammonia. An analysis of hoof meal gave 2.1 per cent. moisture and 19.05 per cent. of ammonia.

MIXED FERTILIZERS

41. For mixing fertilizers to make complete fertilizers, it is necessary to add to the bones and tankage other materials as diluents, and also some form of potash. The latter is most commonly commercial potassium chloride and at times potassium sulphate. The sulphate is regarded as preferable, especially for tobacco fertilizers. The diluents, or fillers, may be any cheap material, such as ashes ground fine or earth, or any more or less bulky material.

Complete fertilizers are materials that contain the elements necessary for the growth of organic matter, which are first extracted from the soil by growing crops. They comprise nitrogen (ammonia), phosphoric acid, and potash.

Direct fertilizers contain certain forms of plant food that contribute directly to the growth and substance of plants. Such materials may contain nitrogen, potash, or phosphoric-acid compounds, or any two, or all three, of these forms of plant food.

Indirect fertilizers are those which do not in themselves furnish directly to the soil any needed plant food, but whose chief value depends on the power they possess of changing unavailable forms of plant food into available forms. Indirect fertilizers include lime, gypsum, and salt.

42. Ingredients of Mixed Fertilizers.—Among the various and most common ingredients used in making complete fertilizers are dried blood, tankage, cottonseed meal, azotine, bones, potassium chloride, potassium sulphate, sodium nitrate, ammonium sulphate, and various forms of phosphates derived principally from phosphate rock.

Tankage, containing, as it ordinarily does, from 7 to 10 per cent. of ammonia, is in too concentrated a form to be used by itself as a fertilizer and at the same time is too expensive. Although, as a rule, there is no objection to using tankage in its natural state, it lacks potash, which is a very essential ingredient in a commercial fertilizer.

Bone, in the form of raw-bone meal, is used for a direct fertilizer. But the objection to using this material is the insoluble form of most of its phosphoric acid content.

A source of nitrogen frequently used in complete fertilizers is found in sodium nitrate, or Chile saltpeter, which contains about 15½ to 16 per cent. of nitrogen. This is ordinarily used in connection with the phosphates, tankage, and other nitrogenous materials. The disadvantage of using sodium nitrate is its free solubility in water, on account of which it washes out of the soil too readily. It is adaptable, however, for crops that mature quickly.

Of late years, owing to the constantly growing demand for nitrogenous material, cottonseed meal has been very extensively employed in making fertilizers. This material is comparatively cheap and is always available in steady quantities. It furnishes an excellent raw material containing about 7 or 8 per cent. of ammonia.

Phosphate rock is a mineral phosphate found in various states. In a raw condition it contains from 25 to 35 per cent. of phosphoric acid. This acid, however, is in an insoluble condition and consequently must be treated with sulphuric acid before the phosphates can be made available. The quantity of acid required varies with the amount of phosphates present as determined by analysis. (See *Quantitative Analysis*.)

Acid phosphates are known under various names such as superphosphates, dissolved rock, etc. They are formed by treating bones, bone black, bone ash, etc. with sulphuric acid, the result being soluble phosphates of calcium and calcium sulphate (gypsum) in nearly equal proportions. Bone products are all valuable fertilizers, as they furnish phosphoric acid and ammonia.

Discarded bone black from sugar refineries also furnishes a source of fertilizer material. This bone black, however, contains no nitrogen.

Garbage tankage also contributes very largely to fertilizer material, this being its only use.

Ammonium sulphate is a by-product from the manufacture of illuminating gas or coke. There are occasions, however, when its high price prevents it from being used in commercial fertilizers.

Potassium salts, such as kainite, kaiserite, etc., used in the manufacture of fertilizers, are obtained principally from the Stassfurt mines. The potassium chloride, known commercially as muriate of potash, generally contains from 50 to 53 per cent. of actual potash. Potassium sulphate from this source ordinarily contains from 48 to 51 per cent. of actual potash.

Fish scrap is also used extensively in fertilizers.

Basic slag, which is the phosphatic slag formed in the basic process of steel making, has been found in recent years to have considerable value as a fertilizer. The phosphoric-acid content varies from 10 to 25 per cent. and probably exists as calcium phosphate. The slag must be very finely ground in order to be of value as a fertilizer.

43. Mixing the Ingredients.—The raw materials just described are mixed in various proportions depending on the use of the fertilizer for certain crops and also on the sale price of the finished product. All materials should be in a finely ground condition as, in addition to its chemical composition, the mechanical condition of a fertilizer is an important consideration, the degree of pulverization or fineness controlling to a great extent the rate of solubility of the ingredients.

The mixing of the various ingredients is merely a mechanical operation and is most commonly done with some form of fertilizer mixer. It is essential that the several ingredients be thoroughly incorporated with one another. The most common form of mixer consists of a shallow, revolving pan in which is placed apparatus for mixing the fertilizer while the pan is revolving. Any form of mixer that will fill the requirements of thorough incorporation may be used for this purpose. With small quantities mixing can be accomplished by numerous siftings and subsequent hand mixing; this method is serviceable for experimental laboratory mixtures. Mechanical mixers that are capable of mixing from 10 to 150 tons of fertilizer every 10 hours can be procured.

44. Formulas for Fertilizer Mixtures.—Each manufacturer has his own formula for making fertilizer. A few formulas will suffice to show the general method of combining the ingredients. For a fertilizer adapted for wheat and grass, the following mixture is prepared:

	Pounds
Steamed bone	1,200
Potassium chloride	45
Filler	755
Total	2,000

An analysis of this mixture will be about as follows:

	Per Cent.
Ammonia	2 to 2.5
Available phosphoric acid	8 to 10.0
Potash	1 to 2.0

Another mixture is as follows:

	Pounds
Steamed bone	900
Tankage (low grade)	190
Potassium chloride	210
Filler	700
Total	2,000

An analysis of this is about as follows:

	Per Cent.
Ammonia	2 to 3
Available phosphoric acid	8 to 9
Potash	5 to 6

A mixture made for a potato fertilizer is compounded with the following ingredients:

	Pounds
Steamed bone	1,000
Sodium nitrate	212
Tankage (low grade)	150
Potassium chloride	365
Filler	273
Total	2,000

This mixture will analyze as follows:

	Per Cent.
Ammonia	4 to 5
Available phosphoric acid	7 to 8
Potash	9 to 10

A so-called potato grade has the following formula:

	Pounds
Steamed bone	570
Sodium nitrate	200
Tankage	900
Potassium chloride	330
Total	2,000

This mixture makes a very high-grade fertilizer containing no filler. It analyzes about as follows:

	Per Cent.
Ammonia	6 to 7
Available phosphoric acid	5 to 6
Potash	8 to 9

A mixture composed of

	Pounds
Bone meal	400
Dissolved bone black	400
Dried blood	300
Sodium nitrate	200
Dissolved phosphate rock	350
Potassium chloride	350
Total	2,000

was found to give on analysis

	Per Cent.
Nitrogen	4.09
Available phosphoric acid	9.59
Insoluble phosphoric acid	2.50
Potash	9.62

Most fertilizers are sold under their special brand and their makers' names, and nearly all states in the United States have stringent laws governing the sale of fertilizer. These laws require that licenses be procured, registration of brands be made, analysis of the material be submitted, etc. They also require that a statement as to the guaranteed analysis be printed on the bags in which the material is sold.

ANALYTICAL METHODS AND TESTS OF PRODUCTS

DETERMINATION OF GRADE OF OILS, TALLOWS, GREASES, ETC.

45. The following analyses and tests, together with those referred to in *Quantitative Analysis* on the analysis of fats and also those on the examination of fertilizers, cover the most important methods used in packing-house laboratories.

46. Determination of Free Fatty Acids in Oils, Tallows, Etc.—To ascertain the amount of free fatty acids in oils, etc., a supply of neutralized alcohol is made by dissolving in ordinary alcohol a small quantity of phenolphthalein and cautiously adding drop by drop a weak solution of alkali until after persistent shaking the alcohol retains a faint pink color. All free acid is now neutralized.

A known weight of oil or fat is placed in an ordinary 4-ounce sample bottle and to it is added 50 or 60 cubic centimeters of the neutralized alcohol. The whole is then shaken and heated on the water bath for 15 to 20 minutes or until hot. If the sample is wholly free from acid the pink color of the alcohol remains unchanged. If free acid is present the alcohol remains decolorized. A half-normal solution of caustic soda is now carefully added until after successive shakings the pink color returns to the alcoholic solution. The reaction is very sharp and the end point, with all material except very dark oils or greases, is well defined. When testing the latter a much larger quantity of alcohol is used and the solution after each shaking is allowed to settle. In this way the color of the underlying solution may more easily be observed.

In ordinary practice, it is customary to consider the free acid present in oils and fats as oleic acid, although this may not actually be the case. The molecular weights of oleic and stearic acids do not differ so widely that the result is materially affected. For example, 1 cubic centimeter of half-normal caustic solution corresponds to .142 gram of stearic acid or to .141 gram of oleic acid.

For oils of average grade, 10 grams is usually taken for the test. For material containing very little free acid, the quantities taken for the test must be correspondingly increased to obtain an accurate result. For poor tallows, from 20 to 25 grams is generally taken. For good tallows and oleo stearins, 50 grams is taken for the test.

47. Determination of the Titer of a Fat.—The **titer** of a fat is the temperature, expressed in degrees centigrade, at which the free fatty acids, extracted from that fat, will solidify. The determination of the titer requires first of all that the fatty acids be obtained free from the glycerine, combined with which they form, as glycerides, the bulk of the fat. In order to obtain the free fatty acids it is necessary to follow a roundabout method, as it is impossible to separate the fatty acids from the glycerine directly, except by subjecting the fat to a degree of heat and pressure and the action of a relatively smaller quantity of chemicals which are liable to cause changes in the free fatty acids.

When an animal fat is treated and heated with a sufficient quantity of a strong alkali, as caustic soda or caustic potash, the glycerides are decomposed; the alkali unites with the free fatty acids, forming soap and liberating the glycerine. The soap formed, when treated with a mineral acid such as hydrochloric or sulphuric acid, is decomposed. The hydrochloric or sulphuric acid combining with the alkali of the soap leaves the free fatty acid as an oily layer on top of the hot aqueous solution of the other constituents. To separate this oily layer the aqueous solution may be drawn off from beneath the fatty acid or the entire mass may be cooked, when the fatty acids will congeal, forming a solid cake which can be removed from the aqueous solution. By washing the free fatty acids with distilled water the adhering traces of mineral acid, etc. are removed; by a subsequent drying all the adhering water is removed and the fatty acids are obtained free from any of the substances originally combined with or added to them in the course of separation.

48. It is absolutely necessary to extract all the fatty acids from the fat and to have no fatty acids in combination with glycerine left in the free fatty acids, the solidifying temperature of which is to be determined. In order to be sure that no such glycerides remain mixed with the fatty acids, it is necessary to saponify the fat completely; that is, to unite all the fatty acids existing in the fat with the alkali. To insure and facilitate the completeness of saponification, alcohol is added when the fat is heated with the strong caustic alkali. The presence of alcohol accelerates the action of the caustic, and under proper conditions insures complete saponification. The alcohol may, however, cause an error if it is not completely removed by evaporation before the soap formed is decomposed by mineral acid. If alcohol is present in the soap when the mineral acid is added, the free fatty acid may combine with such alcohol and form a substance that, mixed with the free fatty acid, will reduce the solidifying temperature of the fatty acid.

Any glycerides left in the fatty acids will have the same effect. It is therefore absolutely necessary to obtain complete saponification and to drive off all the alcohol from the soap formed before such soap is decomposed by a stronger acid. When with the exception of water the fatty acids are separated from all the other substances, there only remains the freeing of the fatty acids from the water before they can be tested for their solidifying point. It has been demonstrated that the manner in which this water is removed may materially influence the solidifying point. The titer is .5° higher when the fatty acids are previously heated for 2 hours at 100° C. than when such heating is not done, or done only for a considerably shorter time.

49. The method of determining the titer, as well as all other methods of fat and oil analysis, unless otherwise specified, are those following, adopted as official by the American Chemical Society, on April 14, 1919, as a result of the report of the Committee on Analysis of Commercial Fats and Oils of the Division of Industrial Chemists and Chemical Engineers of this society:

Fifty grams of fat are saponified with 60 cubic centimeters of a solution of 2 parts of methyl alcohol to 1 of 50 per cent. $NaOH$. The soap is dried, pulverized, and dissolved in 1,000 cubic centimeters of water in a porcelain dish and then decomposed with 25 cubic centimeters of 75 per cent. sulphuric acid. The fatty acids are boiled until clear oil is formed and then collected and settled in a 150-cubic centimeter beaker and filtered into a 50-cubic centimeter beaker. They are then heated to 130° C. as rapidly as possible with stirring, and transferred, after they have cooled somewhat, to the usual 1″×4″ titer tube, placed in a 16-ounce bottle of clear glass, fitted with a cork that is perforated so as to hold the tube rigidly when in position. Suspend the titer thermometer so that it can be used as a stirrer and stir the fatty acids slowly (about 100 revolutions per minute) until the mercury remains stationary for 30 seconds. Allow the thermometer to hang quietly with the bulb in the center of the tube and report the highest point to which the mercury rises as the titer of the fatty acids. The titer should be made at about 20° C. for all fats having a titer above 30° C. and at 10° C. below the titer for all other fats. Any convenient means may be used for obtaining a temperature of 10° below the titer of the various fats. The committee recommends first of all a chill room for this purpose; second, an artificially chilled small chamber with glass window; third, immersion of the bottle in water or other liquid of the desired temperature.

Standard Thermometer

The thermometer is graduated at zero and in tenth degrees from 10° C. to 65° C., with one auxiliary reservoir at the upper end and another between the zero mark and the 10° mark. The cavity in the capillary tube between the zero mark and the 10° mark is at least 1 centimeter below the 10° mark, the 10° mark is about 3 or 4 centimeters above the bulb, the length of the thermometer being about 37 centimeters over all. The thermometer has been annealed for 75 hours at 450° C. and the bulb is of Jena normal 16‴ glass, or its equivalent, moderately thin, so that the thermometer will be quick-acting. The bulb is about 3 centimeters long and 6 millimeters in diameter. The stem of the thermometer is 6 millimeters in diameter and made of the best thermometer tubing with scale etched on the stem, the graduation is clear-cut and distinct but quite fine. The thermometer must be certified by the United States Bureau of Standards.

50. Determination of Moisture and Volatile Matter.—The vacuum oven, which is an important piece of apparatus in the process of determining the moisture and volatile matter content of commercial fats and oils, is the Committee Standard Oven, a brief description of which is herewith appended:

> The standard oven has been designed with the idea of affording a simple and compact vacuum oven which will give as uniform temperatures as possible on the shelf. It consists of an iron casting of rectangular sections with hinged front door made tight by means of a gasket and which can be lowered on opening the oven so as to form a shelf on which samples may be rested. The oven contains but one shelf which is heated from above as well as below by means of resistance coils. Several thermometer holes are provided in order to ascertain definitely the temperature at different points on the shelf. Larger ovens containing more than one shelf have been tried by the committee, but have been found to be lacking in temperature uniformity and means of control. The entire oven is supported by means of a 4-inch standard pipe which screws into the base of the oven and which in turn is supported by being screwed into a blind flange of suitable diameter which rests on the floor or work table.
>
> The standard moisture dish used shall be a shallow, glass dish, lipped, beaker form, approximately 6 to 7 centimeters in diameter and 4 centimeters deep.
>
> Weigh out 5 grams of the prepared sample into a moisture dish. Dry to constant weight *in vacuo* at a uniform temperature not less than 15° C. nor more than 20° C. above the boiling point of water at the working pressure, which must not exceed 100 millimeters of mercury. Constant weight is attained when successive dryings for 1-hour periods show an additional loss of not more than .05 per cent. The loss in weight is of moisture and volatile matter.[1]
>
> The vacuum-oven method cannot be considered accurate in the case of fats of the coconut oil group containing free acid and the committee recommends that it be used only for oils of this group when they contain less than 1 per cent. free acid. In the case of oils of this group containing more than 1 per cent. free acid, recourse should be had

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[1] Results comparable to those of the Standard Method may be obtained on most fats and oils by drying 5-gram portions of the sample prepared and weighed as above, to constant weight in a well-constructed and well-ventilated air oven held uniformly at a temperature of 105° to 110° C. The thermometer bulb should be close to the sample. The definition of constant weight is the same as for the Standard Method.

temporarily to the routine control method for moisture and volatile matter[1] until the committee develops a more satisfactory method.

The air-oven method cannot be considered even approximately accurate in the case of the drying and semi-drying oils and those of the coconut oil group. Therefore, in the case of such oils as cottonseed oil, maize oil (corn oil), soy bean oil, linseed oil, coconut oil, palm kernel oil, etc., the vacuum-oven method should always be used except in the case of fats of the coconut group containing more than 1 per cent. free acid, as noted above.

Insoluble Impurities

Dissolve the residue from the moisture and volatile matter determination by heating it on a steam bath with 50 cubic centimeters of kerosene. Filter the solution through a Gooch crucible properly prepared with asbestos, wash the insoluble matter five times with 10-cubic centimeter portions of hot kerosene, and finally wash the residual kerosene out thoroughly with petroleum ether. Dry the crucible and contents to constant weight as in the determination of moisture and volatile matter and report results as insoluble impurities.

This determination, the title for which was adopted after careful consideration, determines the impurities which have generally been known as dirt, suspended matter, suspended solids, foreign solids, foreign matter, etc., in the past. The first solvent recommended by the committee is hot kerosene to be followed by petroleum ether kept at ordinary room temperature. Petroleum ether, cold or only slightly warm, is not a good fat and metallic soap solvent, whereas hot kerosene dissolves these substances readily, and for this reason the committee has recommended the double solvent method so as to exclude metallic soaps which are determined below as soluble mineral matter.

Soluble Mineral Matter

Place the combined kerosene filtrate and kerosene washings from the insoluble impurities determination in a platinum dish. Place in this an ashless filter paper folded in the form of a cone, apex up. Light the apex of the cone, whereupon the bulk of the kerosene burns quietly. Ash the residue in a muffle, to constant weight, taking care that the decomposition of alkaline earth carbonates is complete, and the result will be the soluble mineral matter.[1] When the percentage of soluble mineral matter amounts to more than .1 per cent., multiply the percentage by 10 and add this amount to the percentage of free fatty acids as determined.[2]

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[1] The following method is suggested by the committee for routine control work: Weigh out 5- to 25-gram portions of prepared sample into a glass or aluminum (*Caution:* Aluminum soap may be formed) beaker or casserole and heat on a heavy asbestos board over burner or hot plate, taking care that the temperature of the sample does not go above 130° C. at any time. During the heating rotate the vessel gently on the board by hand to avoid sputtering or too rapid evolution of moisture. The proper length of time of heating is judged by absence of rising bubbles of steam, by the absence of foam or by other signs known to the operator. Avoid overheating of sample as indicated by smoking or darkening. Cool in desiccator and weigh.

By cooperative work in several laboratories, the committee has demonstrated that this method can be used and satisfactory results obtained on coconut oil even when a considerable percentage of free fatty acids is present, and the method is recommended for this purpose. Unfortunately on account of the very great personal factor involved, the committee cannot establish this method as a preferred method. Nevertheless, after an operator has learned the technique of the method, it gives perfectly satisfactory results for ordinary oils and fats, butter, oleomargarine, and coconut oil, and deserves more recognition than it has heretofore received.

Soluble mineral matter represents mineral matter combined with fatty acids in the form of soaps in solution in the fat or oil. Formerly this mineral matter was often determined in combination by weighing the separated metallic soap or by weighing it in conjunction with the insoluble impurities. Since the soaps present consist mostly of lime soap, it has been customary to calculate the lime present therein by taking .1 the weight of the total metallic soaps. The standard method as given above is direct and involves no calculation. The routine method given in the note has been placed among the methods, although not adopted as a standard method for the reason that it is in use in some laboratories regularly. It should be pointed out, however, that the method cannot be considered accurate.

DETERMINATION OF UNSAPONIFIABLE MATTER

To find the content of unsaponifiable matter, the extraction cylinder used shall be glass-stoppered, graduated at 40 cubic centimeters, 80 cubic centimeters, and 130 cubic centimeters, with a diameter of about 1⅜ inches, and a height of about 12 inches. Redistilled petroleum ether, boiling under 75° C., shall be used as a reagent. A blank must be made by evaporating 250 cubic centimeters with about .25 gram of stearin or other hard fat (previously brought to constant weight by heating) and drying as in the actual determination. The blank must not exceed a few milligrams.

METHOD OF PROCEDURE

Weigh 5 grams of the prepared sample into a 200-cubic centimeter Erlenmeyer flask, add 30 cubic centimeters of redistilled 95 per cent. (approximately) ethyl alcohol and 5 cubic centimeters of 50 per cent. aqueous potassium hydroxide, and boil the mixture for 1 hour under a reflux condenser. Transfer to the extraction cylinder and wash to the 40-cubic centimeter mark with redistilled 95 per cent. ethyl alcohol. Complete the transfer, first with warm then with cold water, till the total volume amounts to 80 cubic centimeters. Cool the cylinder and contents to room temperature and add 50 cubic centimeters of petroleum ether. Shake vigorously for 1 minute and allow to settle until both layers are clear, when the volume of the upper layer should be about 40 cubic centimeters. Draw off the petroleum ether layer as closely as possible by means of a slender glass siphon into a separatory funnel of 500 cubic centimeters capacity. Repeat extraction at least four more times, using 50 cubic centimeters of petroleum ether each time. Wash the combined extracts in a separatory funnel three times with 25-cubic centimeter portions of 10 per cent. alcohol, shaking vigorously each time. Transfer the petroleum ether extract to a wide-mouth tared flask or beaker, and evaporate the petroleum ether on a steam bath in an air-current. Dry as in the method for moisture and volatile matter. Any blank must be deducted from the weight before calculating unsaponifiable matter. Test the final residue for solubility in 50 cubic centimeters petroleum ether at room temperature. Filter and wash free from the insoluble residue, if any, evaporate and dry in the same manner as before. The committee wishes to emphasize the necessity of thorough and vigorous shaking in order to secure accurate results. The two phases must be brought into the most intimate contact possible, otherwise low and disagreeing results may be obtained. When the unsaponifiable matter runs over 5 per cent. more extractions are recommended.

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[1] For routine work, an ash may be run on the original fat, and the soluble mineral matter obtained by deducting the ash on the insoluble impurities from this. In this case the Gooch crucibile should be prepared with an ignited asbestos mat so that the impurities may be ashed directly after being weighed. In all cases ignition should be to constant weight so as to insure complete decomposition of carbonates.

[2] See note on Soluble Mineral Matter following these methods. When the ash contains phosphates the factor 10 cannot be applied, but the bases consisting of calcium oxide, etc., must be determined, and the factor 10 applied to them.

The committee has considered unsaponifiable matter to include those substances frequently found dissolved in fats and oils which are not saponified by the caustic alkalies and which at the same time are soluble in the ordinary fat solvents. The term includes such substances as the higher alcohols, such as cholesterol which is found in animal fats, phytosterol found in some vegetable fats, paraffin and petroleum oils, etc. Unsaponifiable matter should not be confused in the lay mind with insoluble impurities or soluble mineral matter.

Determination of Melting Point

To determine the melting point, capillary tubes made from thin-walled glass tubing with an inside diameter of 5 millimeters drawn out to 1 millimeter inside diameter are used. The length of capillary part of tubes is to be about 5 centimeters. The length of the tube over all is to be 8 centimeters. In addition, a standard thermometer graduated in tenths of a degree and a 600-cubic centimeter beaker are necessary. The sample should be clear when melted and entirely free from moisture, or incorrect results will be obtained.

Melt and thoroughly mix the sample. Dip three of the capillary tubes above described in the oil so that the fat in the tube stands about 1 centimeter in height. Now fuse the capillary end carefully by means of a small blast flame and allow to cool. These tubes are placed in a refrigerator overnight at a temperature of from 40° to 50° F. They are then fastened by means of a rubber band or other suitable means to the bulb of a thermometer graduated in tenths of a degree. The thermometer is suspended in a beaker of water (which is agitated by air or other suitable means) so that the bottom of the bulb of the thermometer is immersed to a depth of about 3 centimeters. The temperature of the water is increased gradually at the rate of about 1° per minute.

The point at which the sample becomes opalescent is first noted and the heating continued until the contents of the tube become uniformly transparent. The latter temperature is reported as the melting point.

Before finally melting to a perfectly clear fluid, the sample becomes opalescent and usually appears clear at the top, bottom, and sides before becoming clear at the center. The heating is continued until the contents of the tube become uniformly clear and transparent. This temperature is reported as the melting point. It is usually only a fraction of a degree above the opalescent point noted. The thermometer should be read to the nearest ½° C., and in addition this temperature may be reported to the nearest degree Fahrenheit if desired.

A melting point is the temperature at which a solid substance assumes the liquid condition. If the solid is a pure substance in the crystalline condition the melting point is sharp and well defined for any given pressure. With increased pressure the melting point is lowered or raised, depending on whether the substance contracts or expands in melting. The lowering or raising of the melting point with pressure is very slight and ordinarily is not taken into consideration. Melting-point determinations are commonly carried out under ordinary atmospheric pressures without correction. The general effect of soluble impurities is to lower the melting point, and this holds true whether the impurity has a higher or lower melting point than the pure substance (solvent). Thus if a small amount of stearic acid be added to liquid palmitic acid and the solution frozen, the melting point of this solid will be lower than that of palmitic acid. Likewise the melting point of stearic acid is lowered by the addition of a small amount of palmitic acid.

The presence of water, especially when this is thoroughly mixed or emulsified with a fat or oil, influences the melting point to a marked extent, causing the mixture to melt through a longer range of temperatures than would be the case if the water were absent. This is particularly true of emulsified fats and oils, such as butter and oleomargarine, both of which contain, besides water, the solids naturally present in milk or cream and including casein, milk sugar, and salts. The melting-point method recommended by the committee is not applicable to such emulsions or other watery mixtures and the committee has found it impossible to devise an accurate method for making softening-point or melting-point determinations on products of this nature. Not only the amount of water present but also the fineness of its particles, that is, its state of subdivision and distribution, in a fat or oil influences the softening point or melting point and causes it to vary widely in different samples.

As a consequence of the foregoing facts, natural fats and oils do not exhibit a definite melting point, composed as they are of mixtures of various crystalline glycerides, higher alcohols, fatty acids, and non-crystalline substances. Therefore, the term melting point when applied to them requires further definition. They exhibit first a lower melting point (the melting point of the lowest melting component) or what might be called the softening point, and following this the fat softens through a shorter or longer range of temperature to the final melting point at which temperature the fat is entirely liquid. This is the melting point determined by the committee's melting-point method. The range between the softening point and the final melting point varies greatly with the different fats and oils depending on their chemical components, the water associated with them, emulsification, etc. In the case of coconut oil the range between softening point and final melting point is rather short; in the case of butter, long. Various methods have been devised to determine the so-called melting point of fats and oils. Most of these methods, however, determine, not the melting point, but the softening point or the flow point of the fat and the great difficulty has been in the past to devise a method which would determine even this point with reasonable accuracy and so that results could be easily duplicated. It has been the aim of the committee to devise a simple method for the determination of the melting point of fats and oils, but it should be understood that the term melting point in the scientific sense is not applicable to natural fats and oils.

Determination of Iodine Number (Wijs Method)

Preparation of Reagents: The iodine solution is prepared by dissolving 13 grams of resublimed iodine in one liter of C. P. glacial acetic acid and passing in washed and dried chlorine gas until the original thiosulphate titration of the solution is not quite doubled. The solution is then preserved in amber glass-stoppered bottles sealed with paraffin until ready for use.

Mark the date, on which the solution is prepared, on the bottle or bottles and do not use if it is more than 30 days old.

There should be no more than a slight excess of iodine, and no excess of chlorine. When the solution is made from iodine and chlorine, this point can be ascertained by not quite doubling the titration.[1]

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[1] P. C. McIlhiney, *J. Am. Chem. Soc.*, 29 (1917), 1222, gives the following details for the preparation of the iodine-monochloride solution:

The preparation of the iodine-monochloride solution presents no great difficulty, but it must be done with care and accuracy in order to obtain satisfactory results. There must be in the solution no sensible excess either of iodine or more particularly of chlorine, over that required to form the monochloride. This condition is most satisfactorily attained by dissolving in the whole of the acetic acid to be used the requisite quantity of iodine, using a gentle heat to assist the

The glacial acetic acid used for preparation of the Wijs iodine solution should be of 99 to 99.5 per cent. strength. In case of glacial acetic acids of somewhat lower strength, the committee recommends freezing and centrifuging or draining as a means of purification.

$N/10$ Sodium Thiosulphate Solution: Dissolve 24.8 grams of C. P. sodium thiosulphate in recently boiled distilled water and dilute with the same to 1 liter at the temperature at which the titrations are to be made.

Starch Paste: Boil 1 gram of starch in 200 cubic centimeters of distilled water for 10 minutes and cool to room temperature.

Potassium Iodide Solution: Dissolve 150 grams of potassium iodide in water and make up to 1 liter.

$N/10$ Potassium Bichromate: Dissolve 4.903 grams of C. P. potassium bichromate in water and make the volume up to 1 liter at the temperature at which titrations are to be made.

Standardization of the Sodium Thiosulphate Solution: Place 40 cubic centimeters of the potassium bichromate solution, to which has been added 10 cubic centimeters of the solution of potassium iodide, in a glass-stoppered flask. Add to this 5 cubic centimeters of strong hydrochloric acid. Dilute with 100 cubic centimeters of water, and allow the $N/10$ sodium thiosulphate to flow slowly into the flask until the yellow color of the liquid has almost disappeared. Add a few drops of the starch paste, and with constant shaking continue to add the $N/10$ sodium thiosulphate solution until the blue color just disappears.

DETERMINATION

Weigh accurately from .10 to .50 gram (depending on the iodine number) of the melted and filtered sample into a clean, dry, 16-ounce glass-stoppered bottle containing 15–20 cubic centimeters of carbon tetrachloride or chloroform. Add 25 cubic centimeters of iodine solution from a pipette, allowing to drain for a definite time. The excess of iodine should be from 50 per cent. to 60 per cent. of the amount added, that is, from 100 per cent. to 150 per cent. of the amount absorbed. Moisten the stopper with a 15 per cent. potassium-iodide solution to prevent loss of iodine or chlorine, but guard against an amount sufficient to run down inside the bottle. Let the bottle stand in a dark place for ½ hour at a uniform temperature. At the end of that time add 20 cubic centimeters of 15 per cent. potassium-iodide solution and 100 cubic centimeters of distilled water. Titrate the iodine with $N/10$ sodium thiosulphate solution which is added gradually, with

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solution, if it is found necessary, setting aside a small portion of this solution, while pure and dry chlorine is passed into the remainder until the halogen content of the whole solution is doubled. Ordinarily it will be found that by passing the chlorine into the main part of the solution until the characteristic color of free iodine has just been discharged there will be a slight excess of chlorine which is corrected by the addition of the requisite amount of the unchlorinated portion until all free chlorine has been destroyed. A slight excess of iodine does little or no harm but excess of chlorine must be avoided.

constant shaking, until the yellow color of the solution has almost disappeared. Add a few drops of starch paste and continue titration until the blue color has entirely disappeared. Toward the end of the reaction stopper the bottle and shake violently so that any iodine remaining in solution in the tetrachloride or chloroform may be taken up by the potassium-iodide solution. Conduct two determinations on blanks which must be run in the same manner as the sample except that no fat is used in the blanks. Slight variations in temperature quite appreciably affect the titer of the iodine solution, as acetic acid has a high coefficient of expansion. It is, therefore, essential that the blanks and determinations on the sample be made at the same time. The number of cubic centimeters of standard thiosulphate solution required by the blank, less the amount used in the determination, gives the thiosulphate equivalent of the iodine absorbed by the amount of sample used in the determination. Calculate to centigrams of iodine absorbed by 1 gram of sample (= per cent. iodine absorbed).

Iodine Number, Tung Oil

The committee has made an extensive study of the application of the Wijs method to the determination of iodine value in the case of tung oil, with the result that it recommends the method for this oil but has thought it desirable to limit the conditions under which the determination is conducted rather narrowly, although reasonably good results are obtained by the committee method without making use of the special limitations.

The cooperative work of the committee and the special investigations conducted by individual members bring out the following points:

Influence of Temperature: From 16° C. to 30° C. there is a moderate increase in the absorption of iodine, but above 30° the increase is rather rapid so that it was thought best to limit the temperature in the case of tung oil to 20° to 25° C.

Influence of Time: The absorption increases with the time, but apparently complete absorption, so far as unsaturated bonds are concerned, occurs well within 1 hour's time. Consequently, 1 hour was set as the practical limit.

Influence of Age of Solution: Old solutions tend to give low results, although up to 2 months no great differences were observed. Nevertheless, it was thought best to limit the age of the solution to 30 days —long enough for all practical purposes.

Saponification Number

With reference to the saponification (Koettstorfer) number, the method of preparation of the reagents is as follows:

N/2 hydrochloric acid, carefully standardized.

Alcoholic Potassium Hydroxide Solution: Dissolve 40 grams of pure potassium hydroxide in 1 liter of 95 per cent. redistilled alcohol (by volume). The alcohol should be redistilled from potassium hydroxide over which it has been standing for some time or with which it has been boiled for some time, using a reflux condenser. The solution must be clear and the potassium hydroxide free from carbonates.

DETERMINATION

Weigh accurately about 5 grams of the filtered sample into a 250- to 300-cubic centimeter Erlenmeyer flask. Pipette 50 cubic centimeters of the alcoholic potassium hydroxide solution into the flask, allowing the pipette to drain for a definite time. Connect the flask with an air condenser and boil until the fat is completely saponified (about 30 minutes). Cool and titrate with the $N/2$ hydrochloric acid, using phenolphthalein as an indicator. Calculate the Koettstorfer number (milligrams of potassium hydroxide required to saponify 1 gram of fat). Conduct two or three blank determinations, using the same pipette and drainage for the same length of time as above.

51. To determine the melting point of fats **Wiley's method** has been adopted as official by the Association of Official Agricultural Chemists. It is based on the fact that a disk of fat when in suspension in a liquid assumes a spheroidal form when melted. The method is described by Wiley as follows:

In the preparation of the apparatus there are required (1) a piece of ice floating in distilled water that has been recently boiled and (2) a mixture of alcohol and water of the same specific gravity as the fat to be examined. This is prepared by boiling distilled water and 95 per cent. alcohol for 10 minutes, to remove the gases that they may hold in solution. While still hot the water is poured into a test tube, described later, until it is almost half full. The test tube is then nearly filled with the hot alcohol, which is carefully poured down the side of the inclined tube to avoid too much mixing. If the alcohol is not added until the water has cooled, the mixture will contain so many air bubbles as to render it unfit for use. These bubbles will gather on the disk of fat as the temperature rises and finally force it to the top.

52. The apparatus for determining the melting point is shown in Fig. 7, and consists of an accurate thermometer *a*, for determining the melting point, reading easily tenths of a degree (it is advisable to use a cathetometer for reading the thermometer, but this may be done with an eye glass if held steadily and properly adjusted); a thermometer *c* for regulating the temperature of the bath; a test tube *d* 35 centimeters high and 10 centimeters in diameter; a test tube *e* 30 centimeters long and 3½ centimeters in diameter; a stand *f* for supporting the apparatus; and some device for stirring the water in the test tube (for example, a blowing bulb *g* of rubber and a bent glass tube extending almost to the bottom of the test tube).

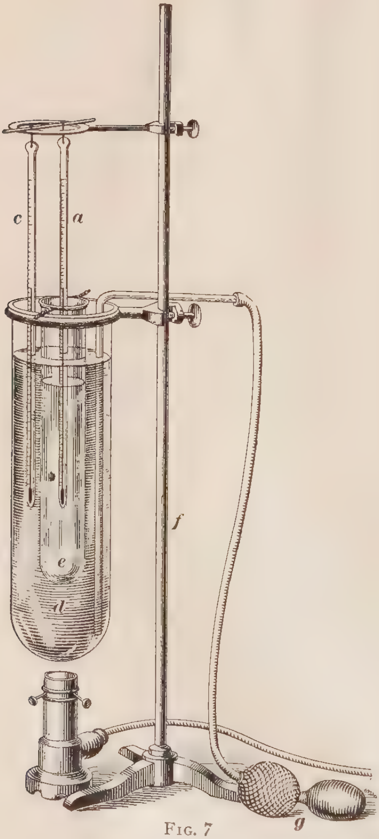

FIG. 7

The disks of fat are prepared as follows: The melted and filtered fat is allowed to fall from a dropping tube, from a height of about 20 centimeters, on a smooth piece of ice floating in recently boiled distilled water. The disks thus formed are from 1 to 1½ centimeters in diameter and weigh about 200 milligrams. By pressing the ice under the water the disks are made to float on the surface, from which they are easily removed with a steel spatula, which should be cooled in the ice water before using. The disks must be allowed to stand for 2 or 3 hours in order to obtain the normal melting point.

53. The test tube *e* containing the alcohol and water is placed in the test tube *d* containing water and ice and left there until cold. The disk of fat is then dropped into *e* from the spatula and at once sinks until it reaches a part of the tube where the density of the mixture of alcohol and water is exactly equivalent to its own. Here the disk remains at rest and free from the action of any force save that inherent in its own molecules.

The delicate thermometer *a* is placed in the test tube *e* and then lowered until the bulb is just above the disk. In order to secure an even temperature in all parts of the alcohol mixture, in the vicinity of the disk, the thermometer is gently moved from time to time in a circularly pendulous manner.

The disk having been placed in position, the water in the the test tube *d* is slowly heated and kept constantly stirred by means of the blowing apparatus *g* already described. When the temperature of the alcohol-water mixture rises to about 6° C. below the melting point, the disk of fat begins to shrivel and it gradually rolls up into an irregular mass.

54. The thermometer is now lowered until the particle of fat is even with the middle point of the bulb. The bulb *d* should be small, so as to indicate only the temperature of the mixture near the fat, and a gentle rotatory movement should be given to the thermometer bulb. The rise of temperature should be so regulated that the last 2° C. of increment requires about 10 minutes. The mass of fat gradually approaches the form of a sphere and when it is sensibly so the reading of the thermometer should be made. When this has been done the tube is removed from the bath and again placed in the cooler. A second tube containing alcohol and water is at once placed in the bath. The test tube (ice water having been used as a cooler) is of low enough temperature to cool the bath sufficiently. After the first determination, which should be only a trial, the temperature of the bath should be so regulated as to reach a maximum of about 15° C. above the melting point of the fat under examination.

The edge of the disk of fat should not be allowed to touch the sides of the tube. This accident rarely happens, but in case it should take place and the disk adheres to the sides of the tube, a new trial should be made.

Triplicate determinations should be made, and the second and third results should agree closely.

In this connection, with the determination of melting points, the melting point of waxes in *Quantitative Analysis* should be referred to. The methods there described are also applicable in some cases to fats, but the method just explained has met with much success and approval. For rapid determinations with a large number of samples, however, the method of Hebner and Angell is to be preferred.

55. Detection of Cottonseed Oil in Oils and Fats. The detection of cottonseed oil is often a matter of importance since its lower cost renders it a likely adulterant of other more expensive oils and fats. Of the various methods which have been proposed, the Halpen test has been chosen as standard, since it is more sensitive and capable of yielding more accurate results than the others. It is not affected by rancidity which is of great importance at times in a test. The depth of color is proportional to a certain extent to the amount of oil present, and by making comparative tests with cottonseed-oil mixtures of known proportions, some idea of the amount present in a mixture of oils under examination can be obtained. In should be remembered, however, that different oils react with different intensities, and cottonseed oils that have been heated to from 200° to 210° C. react with greatly diminished intensity. Heating 10 minutes at 250 C. renders cottonseed oil incapable of giving a reaction.

Lard and lard oil from animals fed on cottonseed meal will give a faint reaction, as will also the fatty acids.

The Halpen test is made as follows: Carbon bisulphide containing about 1 per cent. of sulphur in solution is mixed with an equal volume of amyl alcohol. Equal volumes of this reagent and the oil under examination are then mixed and heated in a bath of boiling saturated brine from 1 to 2 hours. In the presence of as small an amount as 1 per cent. of cottonseed oil, an orange or a red color is produced, which is characteristic.

In the Bechi, or silver-nitrate test for cottonseed oil, rancid oils or fats must first be purified before testing, a condition that Halpen's test does not require.

In connection with the two preceding tests, those described in *Quantitative Analysis* should also be applied. When any single test fails to give results of a most decisive character regarding adulteration, all tests applicable should be applied to the lard, fat, or oil under consideration. Taking all the results together, the absence or presence of cottonseed oil or other adulteration may be determined with comparative certainty.

56. Determination of Tallow in Lard.—It is frequently of importance to have a rapid method of ascertaining whether or not a lard is adulterated with beef fats. While a large proportion of the latter would be made evident to the practical chemist by the altered physical characteristics of pure lard, yet an admixture of a small percentage of tallow or oleo stearin might easily pass unnoticed.

57. A good method for determining small quantities of tallow is **Wesson's method,** which, while not exact in the scientific sense, is so eminently practical, rapid, and easily applicable in the packing house, that it is relied on to give approximate results. It is obvious that the results obtained by this method must be confirmed by further investigation, iodine number, etc., where the result is of importance in legal cases, disputes, etc., but for the matching or duplicating of lard for trade purposes other than domestic, the method has great value and utility.

All fats in a state of fusion a little above their melting points, may be considered as solutions of their solid glycerides in the liquid oils or the oleins. For example, cottonseed oil at ordinary temperatures contains from 20 to 25 per cent. of solid glycerides, which crystallize out as stearin. When the oil is chilled and at a temperature of 0° C., the oil becomes a solid fat. In like manner, prime steam lard at 32° C. is a clear oil from which its solid glycerides crystallize on cooling until at 25° C. the lard becomes solid fat. Prime steam lard contains about 35 per cent. of solid glycerides and about 65 per cent. of olein, which holds the glycerides in solution at 30° to 32° C., and in some instances lower.

The solid glycerides from tallow are far less soluble in olein than those from lard and crystallize out at much higher temperatures. Owing to this fact, it is possible to detect with ease and certainty the solid glycerides of beef fat, namely, oleo stearin, when it exists in lard in quantities of 5 per cent. and upwards.

58. Wesson's process, which is very simple, is carried out as follows:

First, determine the titer of the fat under examination. The Dalican titer or crystallization temperature of the fatty acids indicates approximately the proportions of liquid and fluid acids present.

Second, prepare with materials of known purity—prime lard and prime-lard stearin—a mixture that will possess about the same titer as the sample. Pour some of the melted standard into one test tube and a like quantity into another; at the same time have another test tube that contains a mixture of lard hardened to the same titer with oleo stearin. All the tubes are now brought to the same temperaure in a beaker of hot water and immersed in a bath of water at about 35° C. As the bath cools down, the tubes are watched from time to time and the temperatures and times at which they deposit crystals and their manners of crystallization are noted.

If the sample under examination consists of pure lard stock, it will cool in a manner similar to the standard mixture. If oleo stearin is present, the sample will deposit crystals, or become cloudy sooner and at a higher temperature than the standard, and comparison with the samples prepared with oleo stearin will show the approximate percentage, which will be confirmed by the Dalican titer, taking into consideration the approximate amount of cottonseed oil that may be present. The manner of cooling is quite characteristic. Pure lard stock generally forms comparatively large stellate, or starlike, bundles of crystals, while those from oleo stearin are very small, and appear as a cloud. A few trials with mixtures of known composition will make these appearances familiar and unmistakable.

It is of the utmost importance that the lards should be dry and clear, as moisture will cause a lard to cloud above its normal temperature. With this test, soft tallow and oleomargarine, having not too low melting and cooling points on account of the excess of olein in them, give the indications of quantities of oleo stearin proportional to their hardness; and in some cases where the flavor and appearance of the sample indicate tallow rather than oleo stearin, it is the custom to report tallow equivalent to so much oleo stearin.

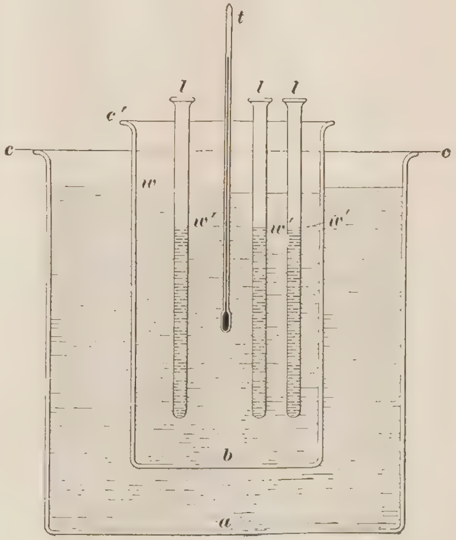

Fig. 8

With lards of comparatively high titer and consequently high cooling point, it is necessary to consider the effect of lard stearin on the titer when calculating the probable composition. Ten per cent. of oleo stearin mixed with pure lard will deposit crystals and show cloudiness before a mixture of 50 per cent. of lard and 50 per cent. of lard stearin.

59. The arrangement of the apparatus used for this determination is shown in Fig. 8. A beaker *a* having a capacity of about 750 cubic centimeters is covered with a piece of thin wood, cardboard, or metal *c*. This cover is provided with a circular aperture, through which passes a smaller beaker *b*. The cover *c'* is provided with orifices for a number of test tubes *l*, which contain the samples and standards of comparison. A thermometer *t* serves to indicate the temperature in the beaker *b*. The inner beaker *b* is filled with water up to the point marked *w*, which should be a little above the surface *w′* of the melted lards.

60. The **A. O. A. C. method,** which has been adopted by the Association of Official Agricultural Chemists, as tentative, is much more accurate:

Weigh out 5 grams of the filtered fat into a 25-cubic centimeter glass-stoppered cylinder, graduated, and add warm acetone until the 25-cubic centimeter mark is reached. Shake the cylinder until the contents are thoroughly mixed; then allow the cylinder and contents to stand in a suitable place in which a temperature of 30° C. is maintained. After 18 hours remove the cylinder and carefully decant the supernatant liquid from the crystallized glycerides, which are usually found in a firm mass at the bottom of the cylinder. Then add warm acetone in three portions of 5 cubic centimeters each from a small wash bottle, care being taken not to break up the deposit while washing and decanting the first two portions. Agitate actively the third portion in the cylinder and, by a quick movement, transfer the same to a small filter paper. Wash the crystals with five successive small portions of the warm acetone by means of a wash bottle and remove the excess acetone by suction. Transfer the paper with its contents to a suitable place where it should be spread out and any large lumps of the glycerides broken up by gentle pressure. When dry thoroughly comminute the mass and determine the melting point of the crystals. A melting point below 63° is regarded as evidence of adulteration and as suspicious.

61. After the melting point of the crystallized glycerides has been determined, transfer them to a 50-cubic centimeter beaker, add 25 cubic centimeters of approximately $N/2$ alcoholic potassium hydroxide and heat on the steam bath until saponification is complete. Pour the solution into a separatory funnel containing 200 cubic centimeters distilled water, acidify, add 75 cubic centimeters of ether, and shake. Draw off the acid layer and wash at least three times with distilled water. Transfer the ether solution to a clean dry 50-cubic centimeter beaker, drive off the ether on the steam bath and finally dry the acids at 100° C. After the acids have stood for at least 2 hours after drying, determine the melting point in the same manner in which the melting point of the crystals was determined. If the melting point of the glycerides plus twice the difference between the melting point of the glycerides and the melting point of the fatty acids is less than 73° C., the lard is regarded as adulterated.

62. The melting point of glycerides and fatty acids is to be determined in the following manner: A large test tube, approximately 150×35 millimeters containing water (free from air) into which the bulb of a thermometer (graduated in $\frac{1}{5}$ degrees from 1 to 100) with the melting-point tube attached is immersed, is placed in a beaker of water and so adjusted that the surface of the liquid contained in the two vessels is at the same level. The water in the beaker should be heated rapidly to about 50° C. and that temperature maintained until the thermometer carrying the melting-point tube registers between 50° and 55°, then heat is again applied and the temperature of the outer bath carried somewhat rapidly to 67°, when the lump is removed. The melting point of the crystals is regarded as that point when the fused substance becomes perfectly clear and transparent. The use of a dark background placed about 4 inches from the apparatus will be of advantage.

63. The melting-point tube should be of about 1 millimeter internal diameter, sealed at one end, with a slight flare at the other extremity in order that the loading may be expedited. The amount of the substance taken should be approximately the same for all the determinations and should occupy a space about 9 millimeters in length, being somewhat firmly packed in the lower end of the tube by tapping it sharply on a hard surface. The water in the outer bath should be agitated frequently during the determination.

In the A. O. A. C. method there are several possible sources of error that must be carefully avoided. The fat must be filtered and free from dirt and moisture, as these may hinder proper crystallization. The crystal mass should be compact and the crystallization not too rapid, as this may give rise to a larger mass of small fluffy crystals. The temperature should be as indicated if higher crystallization is not to take place. The crystals must be carefully washed to make sure that softer fats are not retained by the crystal mass. The fat must be completely in solution in the acetone before crystallization is allowed to proceed.

64. Cold Test of Animal Oils.—The cold test is a trade requirement with most animal oils. The sample of oil must be thoroughly mixed, to insure uniformity. If the oil is frozen or chilled, it must be warmed and melted to a uniform consistency. The test is made as follows:

About 1 ounce of the oil to be tested is put into a common 4-ounce sample bottle, and in the oil is placed a short, stout thermometer. The bottle is then placed in a situation where the oil will become frozen; if necessary, a freezing mixture is used. (In connection with this test, see *Quantitative Analysis* under the heading Cloud Test in Mineral Oils.) When the liquid has become solid throughout, the bottle is removed from the cold and the oil allowed to soften. At the same time the oil is thoroughly stirred and mixed with the thermometer until the mass will run from one end of the bottle to the other. The neck of the bottle is now grasped by one hand, which should hold some waste or a towel to enclose the thermometer. The latter is withdrawn through the waste or towel, so as to wipe far enough to see the mercury, and the temperature is observed. The reading is the cold test of the oil.

METHODS OF FERTILIZER ANALYSIS

65. The following methods are those ordinarily used in the packing-house laboratory in the analysis of fertilizers and tankages. These methods have been adopted by the Association of Official Agricultural Chemists as the official methods to be used on such products.

66. Determination of Moisture.—Heat 2 grams of the sample for 5 hours in a water oven at the temperature of boiling water. In the case of potash salts, sodium nitrate, and ammonium sulphate, heat at about 130° C. to constant weight. The loss in weight is considered as moisture.

67. Preparation of Solutions.—The solutions used in the analysis of fertilizers are prepared as follows:

Ammonium Molybdate Solution.—A solution of ammonium molybdate is prepared as follows: Dissolve 100 grams of molybdic acid in dilute ammonium hydroxide (144 cubic centimeters of ammonium hydroxide and 271 cubic centimeters of water); pour this solution slowly and with constant stirring into dilute nitric acid (489 cubic centimeters of nitric acid and 1,148 cubic centimeters of water). Keep the mixture in a warm place for several days. Decant the solution from any sediment and preserve in glass-stoppered bottles.

Sodium-Hydroxide Solution.—This solution should be made up of such strength that 1 cubic centimeter is exactly equivalent to .001 gram of phosphorus pentoxide, P_2O_5. In order to calculate the strength of this solution, the equation which represents the reaction which takes place between sodium hydroxide and ammonium phosphomolybdate, is made use of.

$$2(NH_4)_3PO_4(MoO_3)_{12}+46NaOH=2(NH_4)_2HPO_4$$
$$+(NH_4)_2MoO_4+23Na_2MoO_4+22H_2O$$

From this equation it is seen that 46 molecules of sodium hydroxide correspond to 2 molecules of ammonium phosphomolybdate and since the latter also contains the equivalent of 1 molecule of phosphorus pentoxide, 46 molecules of sodium hydroxide are equivalent to 1 molecule phosphorus pentoxide in the above reaction.

The molecular weight of $46NaOH$ is 1840.368.

The molecular weight of P_2O_5 is 142.08.

Then, 142.08 : .001 gram : : 1840.368 : X; $X = .0129$ gram $NaOH$ equivalent to .001 gram of P_2O_5.

Therefore, a solution should be made up; each cubic centimeter of which contains .0129 gram $NaOH$. Thus 1,000 cubic centimeters would contain 12.9 grams $NaOH$. It is practically impossible to make up an accurate solution by weighing out this quantity of $NaOH$ and dissolving it in water and diluting to

1,000 cubic centimeters, but if a normal solution of sodium hydroxide is at hand, it may be diluted to the required strength as follows:

$$1 \text{ cubic centimeter } \frac{N}{1}\ NaOH \text{ contains .04 gram } NaOH$$

Then, $.04 \div .0129 = 3.1$, or if 1 cubic centimeter of normal sodium hydroxide solution is diluted to 3.1 cubic centimeters, the resulting solution will be of the required strength.

Nitric-Acid Solution.—This solution should be of such strength that 1 cubic centimeter exactly equals 1 cubic centimeter of the sodium hydroxide solution. This is accomplished by titrating a nitric acid solution of approximate strength against the standard sodium hydroxide solution, using phenolphthalein as an indicator.

Phenolphthalein Solution.—Dissolve 1 gram of phenolphthalein in 100 cubic centimeters of alcohol.

68. Determination of Phosphoric Acid.—Weigh out a 2-gram sample of the fertilizer in a 250-cubic centimeter volumetric flask, add 30 cubic centimeters of concentrated nitric acid and about 5 cubic centimeters of concentrated hydrochloric acid and boil until the solution becomes clear, adding more nitric acid to replace that which boils away, if necessary. When the sample has dissolved, cool the solution to the temperature marked on the flask (usually 20° C.) and then dilute it to exactly 250 cubic centimeters with water at the same temperature. Now transfer 50 cubic centimeters (.4 gram) of this solution to an Erlenmeyer flask and neutralize it with ammonium hydroxide and then clear up the solution with a few drops of nitric acid. To the hot solution (about 60° C.) add from 30 to 50 cubic centimeters of ammonium molybdate solution. Shake for about 5 minutes, then allow the precipitate of ammonium phosphomolybdate to stand at about 60° C., for 15 to 20 minutes. Filter and wash the precipitate free from all acid, with cold water. This will require from four to five washings. Now transfer the well-washed precipitate and paper to a beaker and dissolve the precipitate in a known quantity of sodium hydroxide solution (about 10 cubic centimeters) measured from a burette. Break up the filter paper in the beaker and add a few drops of phenolphthalein solution. Then titrate with the nitric acid solution. Subtract the number of cubic centimeters of nitric acid solution used, from the number of cubic centimeters of sodium hydroxide solution added. The difference represents the number of cubic centimeters of sodium hydroxide solution used in dissolving the precipitate. The number of cubic centimeters of sodium hydroxide solution so used, multiplied by .001 gives the number of grams of P_2O_5 in the sample. This result multiplied by 100 and divided by the weight of the sample taken (.4 gram) gives the per cent. of P_2O_5.

69. Determination of Nitrogen. — The following reagents are used for the determination of nitrogen by the Kjeldahl method.

Standard Acid: Half-normal sulphuric acid carefully standardized:

Standard Alkali: Half-normal sodium hydroxide solution.

Sulphuric Acid: Specific gravity 1.84. Free from nitrates and ammonium sulphate.

Metallic Mercury: Redistilled.

Granulated Zinc: To prevent bumping.

Potassium Sulphide Solution: Dissolve 40 grams in 1 liter of water.

Sodium Hydroxide Solution: Saturated solution free from nitrates.

Methyl Red: One gram in 100 cubic centimeters of 95 per cent. alcohol.

To determine the amount of nitrogen, place .7 to 3.5 grams, according to the nitrogen content of the substance to be analyzed, in a digestion flask with approximately .7 gram metallic mercury and add 20 to 30 cubic centimeters of sulphuric acid. Place the flask in an inclined position and heat below the boiling point of the acid until frothing has ceased. Then increase the heat until the acid boils briskly and digest for a time after the mixture is colorless or nearly so, or until oxidation is complete.

After cooling, dilute with about 200 cubic centimeters of water, add a few pieces of granulated zinc if necessary to prevent bumping, and 25 cubic centimeters of potassium sulphide solution with shaking. Next add sufficient sodium hydroxide solution to make the reaction strongly alkaline, 50 cubic centimeters are usually enough, pouring it down the side of the flask so that it does not mix at once with the acid solution. Connect the flask with the condenser, mix the contents by shaking, distil until all ammonia has passed over into a measured quantity of the standard acid, and titrate with the standard alkali. The first 150 cubic centimeters of the distillate will generally contain all of the ammonia.

Previous to use, the reagents should be tested by a blank experiment with sugar. The sugar partially reduces any nitrate that might otherwise escape notice.

70. Determination of Potash.—The following chemicals are employed to detect the presence of potash:

Ammonium Chloride Solution: Dissolve 100 grams of ammonium chloride in 500 cubic centimeters of water, add 5 to 10 grams of pulverized potassium platinic chloride and shake at intervals of 6 to 8 hours. Allow the mixture to settle overnight and filter. The residue may be used for the preparation of a fresh supply.

Platinum Solution: A platinic chloride solution containing the equivalent of 1 gram of metallic platinum (2.1 gram of H_2PtCl_6) in every 10 cubic centimeters.

Eighty Per Cent. Alcohol: Specific gravity .8593 at 20° C.

To detect the presence of potash, place 2.5 grams of the sample upon a 12.5-centimeter filter paper and wash into a 250-cubic centimeter flask with successive portions of boiling water until the filtrate amounts to about 200 cubic centimeters. Add to the hot solution a slight excess of ammonium hydroxide and sufficient ammonium oxalate to precipitate all of the lime present. Cool, dilute to 250 cubic centimeters, mix, and pass through a dry filter. Evaporate nearly to dryness a 50-cubic centimeter aliquot of the solution, add 1 cubic centimeter of dilute sulphuric acid (1:1), evaporate to dryness, and ignite to whiteness. Maintain a full red heat until the residue is perfectly white. Dissolve the residue in hot water, using at least 20 cubic centimeters for each decigram of potassium oxide present, add a few drops of hydrochloric acid and platinum solution in excess. Evaporate on the water bath to a thick paste. Treat the residue with 80 per cent. alcohol, avoiding exposure to ammonia. Filter, wash the precipitate thoroughly with 80 per cent. alcohol both by decantation and on the filter, continuing the washing after the filtrate is colorless. Then wash with 10 cubic centimeters of ammonium chloride solution to remove impurities from the precipitate and repeat five or six times. Wash again thoroughly with 80 per cent. alcohol and dry the precipitate for 30 minutes at 100° C. Weigh the precipitate of potassium platinic chloride, K_2PtCl_6, and multiply by .161 to obtain the weight of K; by .194 to obtain K_2O; and by .307 to obtain KCl.

71. Determination of Crude Fat or Ether Extract. Extract about 2 grams of material that has been dried, with anhydrous ether for 16 hours. Dry the extract at the temperature of boiling water for 30 minutes, cool in a desiccator, and weigh; continue at 30-minute intervals this alternate drying and weighing until the weight becomes constant.

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REGULATIONS GOVERNING THE MEAT INSPECTION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE

REGULATION 1. DEFINITIONS

SECTION 1. For the purposes of these regulations the following words, phrases, names, and terms shall be construed, respectively, to mean—

Paragraph 1. **The meat inspection act, or act of June 30, 1906, or act of Congress of June 30, 1906:** "An Act Making appropriations for the Department of Agriculture for the fiscal year ending June thirtieth, nineteen hundred and seven," approved June 30, 1906 (34 United States Statutes at Large, pages 674 to 679), as reenacted by "An Act Making appropriations for the Department of Agriculture for the fiscal year ending June thirtieth, nineteen hundred and eight," approved March 4, 1907 (34 United States Statutes at Large, pages 1260 to 1265).

Paragraph 2. **The imported meat act:** The "free list" clause and paragraph 545 of an act entitled "An Act To reduce tariff duties and to provide revenue for the Government, and for other purposes," approved October 3, 1913 (38 United States Statutes at Large, pages 114, 152, 159).

Paragraph 3. **The food and drugs act:** "An Act For preventing the manufacture, sale, or transportation of adulterated or misbranded or poisonous or deleterious foods, drugs, medicines, and liquors, and for regulating traffic therein, and for other purposes," approved June 30, 1906 (34 United States Statutes at Large, pages 768 to 772), as amended by "An Act To amend section eight of the food and drugs act approved

June thirtieth, nineteen hundred and six," approved August 23, 1912 (37 United States Statutes at Large, pages 416 and 417), and by "An Act To amend section eight of an act entitled 'An Act For preventing the manufacture, sale or transportation of adulterated or misbranded or poisonous or deleterious foods, drugs, medicines, and liquors, and for regulating traffic therein, and for other purposes,' approved June thirtieth, nineteen hundred and six," approved March 3, 1913 (37 United States Statutes at Large, page 732).

Paragraph 4. **The department:** The United States Department of Agriculture.

Paragraph 5. **Bureau:** The Bureau of Animal Industry of the United States Department of Agriculture.

Paragraph 6. **Inspector:** An inspector of the Bureau of Animal Industry.

Paragraph 7. **Bureau employes:** Inspectors and all other individuals employed in the Bureau of Animal Industry who are authorized by the chief of bureau to do any work or perform any duty in connection with meat inspection.

Paragraph 8. **Official establishment:** Any slaughtering, meat canning, curing, smoking, salting, packing, rendering, or other similar establishment at which inspection is maintained under these regulations.

Paragraph 9. **Official station:** One or more official establishments included under a single supervision.

Paragraph 10. **"Inspected and passed," or "U. S. inspected and passed," or "U. S. inspected and passed under the act of Congress of June 30, 1906," or "U. S. inspected and passed by Department of Agriculture," or any authorized abbreviations thereof:** That the carcasses, parts of carcasses, meat, meat products, or meat food products so marked have been inspected and passed under these regulations, and that at the time they were inspected, passed, and so marked they were found to be sound, healthful, wholesome, and fit for human food.

Paragraph 11. **"Passed for sterilization":** That the carcasses, parts of carcasses, meat, meat products, or meat food products so marked have been inspected and passed on condition that they be rendered into lard or tallow as prescribed by regulation 15 or otherwise sterilized by methods approved by the chief of bureau.

Paragraph 12. **"U. S. inspected and condemned," or any authorized abbreviation thereof:** That the carcasses, parts of carcasses, meat, meat products, or meat food products so marked are unsound, unhealthful, unwholesome, or otherwise unfit for human food.

Paragraph 13. **"U. S. retained":** That the article so marked is held for further examination by an inspector to determine its disposal.

Paragraph 14. **"U. S. suspect," or any authorized abbreviation thereof:** That the animal so marked is suspected of being affected with a disease or condition which may require its condemnation, in whole or in part, when slaughtered, and is subject to further examination by an inspector to determine its disposal.

Paragraph 15. **"U. S. condemned":** That the animal so marked has been inspected and found to be immature, or in a dying condition, or to have died otherwise than by slaughter, or to be affected with any other condition or with any disease that will require condemnation of its carcass.

Paragraph 16. **"U. S. refused entry":** That the article so marked, offered for importation, contains a preservative not permitted by these regulations, but contains no substance in conflict with the laws of the foreign country from which exported, and has not been found to be otherwise unsound, unhealthful, unwholesome, or unfit for human food.

Paragraph 17. **Inspection legend:** A mark, or a statement, authorized by these regulations, on an article or on the container of an article, indicating that the article has been inspected and passed for food by an inspector.

Paragraph 18. **Carcass:** All parts, including viscera, of a slaughtered animal that are capable of being used for human food.

Paragraph 19. **Primal parts:** The usual sections, cuts, or parts of the dressed carcass commonly known in the trade, such as sides, quarters, shoulders, hams, backs, bellies, beef tongues, and beef livers, before they have been cut, shredded, or otherwise subdivided preliminary to use in the manufacture of meat food products.

Paragraph 20. **Meat product:** Any edible part of the carcass of any cattle, sheep, swine, or goat, which is not manufactured, cured, smoked, processed, or otherwise treated.

Paragraph 21. **Meat food product:** Any article of food or any article which enters into the composition of food for human consumption, which is derived or prepared, in whole or in part, from any portion of the carcass of any cattle, sheep, swine, or goat, if such portion is all or a considerable and definite portion of the article, except such articles as organo-therapeutic substances, meat juice, meat extract, and the like, which are only for medicinal purposes and are advertised only to the medical profession.

Paragraph 22. **Meat and products:** Carcasses, parts of carcasses, meat, products, food products, meat products, and meat food products of, or derived from, cattle, sheep, swine, and goats, which are capable of being used as food by man.

Paragraph 23. **Meat or product:** Any part or all of meat and products.

Paragraph 24. **Immediate container, or true container:** The unit can, pot, tin, canvas, or other receptacle or covering in which any meat or product is customarily delivered to consumers.

Paragraph 25. **Shipping container, or outside container:** The box, bag, barrel, crate, or other receptacle or covering inclosing any meat or product packed in two or more immediate or true containers.

Paragraph 26. **Person:** Natural persons, individuals, firms, partnerships, corporations, companies, societies, and associations, and every agent, officer, or employe of any thereof. This term shall import both the plural and the singular as the case may be.

Paragraph 27. **Subsidiary:** Any individual, firm, partnership, corporation, company, or association, in whose name any business is done, controlled, or owned, in whole or in part, directly or indirectly, by another.

SECTION 2. Wherever in these regulations the phrase "inspected and passed under the provisions of (or according to) the act of Congress of June 30, 1906" is authorized or required to be used, the phrase "U. S. inspected and passed by Department of Agriculture" may be substituted therefor.

SECTION 3. On and after 3 years from the date of the order adopting these regulations the phrase "inspected and passed under the provisions of (or according to) the act of Congress of June 30, 1906" shall not be used as an inspection legend, unless hereafter expressly authorized by the Secretary of Agriculture upon its being shown to his satisfaction that continuance of the use thereof for a longer period is equitable and is rendered necessary in order to utilize stocks of labels on hand or ordered at the time this regulation takes effect.

REGULATION 2. SCOPE OF INSPECTION

SECTION 1. Every establishment in which cattle, sheep, swine, or goats are slaughtered for transportation or sale as articles of interstate or foreign commerce, or in which carcasses, parts of carcasses, meat, meat products, or meat food products of, or derived from, cattle, sheep, swine, or goats are, wholly or in part, canned, cured, smoked, salted, packed, rendered, or otherwise prepared for transportation or sale as articles of interstate or foreign commerce which are capable of being used as food for man, shall have inspection under these regulations, except as expressly exempted by regulation 4.

SECTION 2. All cattle, sheep, swine, and goats and all meat and products entering an establishment at which inspection is required by these regulations, and all meat and products prepared, in whole or in part, therein, shall be inspected, handled, prepared, and marked as required by these regulations.

REGULATION 3. ORGANIZATION OF FORCE

SECTION 1. Meat inspection is conducted, under the direction of the Secretary of Agriculture, by the Bureau of Animal Industry. All permanent employes engaged in the work of meat inspection are appointed upon certification of the United States Civil Service Commission that they have passed the examination prescribed by that commission. These employes are classified as shown in the following sections of this regulation. Promotions are made on the basis of efficiency, deportment, and length of service.

SECTION 2. **Inspectors in charge.** These are inspectors assigned to supervise and perform official work at each official station. Such employes report directly to the chief of bureau and are chosen by reason of their fitness for responsibility as determined by their records in the service. At stations where slaughtering is conducted, only veterinary inspectors are placed in charge.

SECTION 3. **Veterinary inspectors.** All applicants examined for these positions must be graduates of veterinary colleges, accredited by the United States Civil Service Commission, having a course of not less than 3 years leading to a degree. Veterinary inspectors perform all final post-mortem examinations and enforce the sanitary requirements in their departments, under the direction of the inspector in charge.

SECTION 4. **Traveling veterinary inspectors.** These employes inspect official stations and the conduct of operations and ascertain whether the regulations and instructions governing meat inspection are properly observed. They also confer with and instruct bureau employes with a view to uniformity and efficiency of the service, and report thereon, with recommendations, to the chief of bureau.

SECTION 5. **Laboratory inspectors.** These employes possess technical education and training in the microscopical and chemical examination of meat and products, and their inspections are conducted in laboratories located at various slaughtering centers. Pathological laboratories are also maintained, to which diseased specimens may be sent, when necessary, for diagnosis.

SECTION 6. **Lay inspectors.** These employes are laymen who assist veterinary inspectors in ante-mortem and post-mortem inspections, supervise the curing, canning, packing, and other preparation, handling, and marking of meat and products, examine such articles to detect unsound or unfit conditions, assist in the enforcement of sanitary requirements, and perform various other duties.

REGULATION 4. APPLICATIONS FOR INSPECTION OR EXEMPTION; RETAIL BUTCHERS, RETAIL DEALERS, AND FARMERS; DECLARATIONS FOR INEDIBLE PRODUCTS ESTABLISHMENTS

SECTION 1. *Paragraph 1.* The proprietor or operator of each establishment of the kind specified in section 1 of regulation 2 shall make application to the Secretary of Agriculture for inspection or for exemption from inspection, or shall file with the Secretary of Agriculture the declaration prescribed by paragraph 1 of section 6 of this regulation. Every application and declaration under this regulation shall be made on a form furnished by the Bureau of Animal Industry, Washington, D. C. In cases where inspection or exemption is already in effect, new applications for inspection or exemption shall not be required. In cases of change of ownership or change of location, a new application shall be made.

Paragraph 2. Triplicate copies of plans, properly drawn to scale, and of specifications, including plumbing and drainage, of plants shall accompany, and the prints or diagrams required by section 2 of regulation 13 should accompany, applications for inspection.

Paragraph 3. Each application shall specify the names and addresses of all the applicant's subsidiaries doing any of the business described in section 1 of regulation 2 and the location of each establishments of such subsidiaries. Each subsidiary making an application shall specify the name and address of the person, firm, corporation, or association of which it is a subsidiary.

Paragraph 4. Notice in writing shall be given to each applicant granted inspection, specifying the establishment to which the same applies.

Paragraph 5. Inspection or exemption may be refused, or if granted may be revoked, for any false statement in the application therefor.

SECTION 2. Retail butchers and retail dealers in meat and meat food products, supplying their customers, upon making application, pursuant to section 1 of this regulation, may be exempted from inspection. To each one so exempted a numbered certificate of exemption shall be furnished for use with transportation agencies to procure the movement of his products in interstate or foreign commerce. No certificate shall be issued unless all the premises on which the products are prepared and handled are maintained in a sanitary condition. Failure by certificate holders to maintain sanitary conditions or to conform to such of these regulations as apply to them shall be cause for withdrawal of exemption and the cancellation of certificates. Such exempted establishments shall conform to the same regulations as govern official establishments in regard to labeling and the use of dyes, chemicals, and preservatives.

SECTION 3. No holder of a certificate of exemption shall use the same for any purpose except for making shipments in supplying his own customers.

SECTION 4. The carcasses and products of animals slaughtered by any farmer on the farm, provided they can be identified as such and are sound, healthful, wholesome, and fit for human food, and otherwise meet the requirements of these regulations, may be transported in interstate or foreign commerce under the provisions of section 8 of regulation 25. In order to procure the transportation of such products, a farmer need not apply for exemption from inspection.

SECTION 5. Inspectors shall make inspections to ascertain whether any of these regulations applying to retail butchers, retail dealers, farmers, or other persons has been violated.

SECTION 6. *Paragraph 1.* The proprietor or operator of each grease-rendering or grease-refining establishment, and of every other establishment which has not been granted inspection or exemption, which prepares or ships any article or articles derived wholly or in part from cattle, sheep, swine, or goats for interstate or foreign commerce, or in the District of Columbia, a Territory, or other place under the jurisdiction of the United States, which article or articles it is claimed are not capable of being used as food by man, shall file with the Secretary of Agriculture a declaration that none of such articles are for human consumption, nor will be sold or shipped from such establishment otherwise than in compliance with these regulations, and that no article for human consumption derived wholly or in part from cattle, sheep, swine, or goats will be prepared at or in such establishment, or will be sold or shipped therefrom. Such establishments may be inspected at any time to ascertain whether any article derived wholly or in part from cattle, sheep, swine, or goats is prepared therein for human consumption, or whether any declaration filed or offered for filing is false in any particular.

Paragraph 2. The proprietor or operator of each establishment which has been granted inspection or exemption and which prepares therein any article or articles derived wholly or in part from cattle, sheep, swine, or goats for interstate or foreign commerce, or in the District of Columbia, a Territory, or other place under the jurisdiction of the United States, which article or articles it is claimed are not capable of being used as food by man, shall file with the Secretary of Agriculture a declaration that none of such articles are for human consumption nor will be sold or shipped from such establishment otherwise than in compliance with these regulations.

Paragraph 3. The Secretary of Agriculture may refuse to file, or if previously filed may withdraw from his files and cancel, any declaration which is false in any particular or the terms of which are violated in any respect.

REGULATION 5. OFFICIAL NUMBERS AND INAUGURATION AND WITHDRAWAL OF INSPECTION

SECTION 1. *Paragraph 1.* To each establishment granted inspection an official number shall be assigned. Such number shall be used to identify all inspected and passed meat and products prepared in the establishment.

Paragraph 2. Two or more official establishments under the same ownership or control may be granted the same official number, provided a serial letter is added in each case to identify each establishment and the products thereof.

Paragraph 3. No meat or product shall be handled or prepared in an official establishment for a subsidiary of the proprietor or operator, nor shall any article handled or prepared therein be sold or transported in interstate or foreign commerce by or in the name of a subsidiary of the proprietor or operator, unless such subsidiary is named in an application of the establishment for inspection, and is granted inspection in such establishment, under these regulations.

SECTION 2. Each official establishment shall be separate and distinct from any unofficial establishment in which any meat or product is handled.

SECTION 3. Inspection shall not be begun if an establishment is not in a sanitary condition nor unless the establishment provides and agrees to maintain adequate facilities for conducting such inspection.

SECTION 4. When an application for inspection is granted, the inspector in charge shall, at or prior to the inauguration of inspection, inform the proprietor or operator of the establishment of the requirements of these regulations. If the establishment, at the time inspection is inaugurated, contains any meat or product which has not theretofore been inspected, passed, and marked in compliance with these regulations, the identity of the same shall be maintained and it shall not be transported or offered for transportation in interstate or foreign commerce, or otherwise dealt with, as inspected and passed under these regulations. The establishment shall adopt and enforce all necessary measures, and shall comply with all such directions as the inspector in charge may prescribe, for carrying out the purposes of this section.

SECTION 5. Inspection may be withdrawn from any official establishment which violates or fails to comply with any provision of the meat inspection act or of these regulations.

SECTION 6. Inspectors and other bureau employes shall report to the inspector in charge all violations and failures under section 5 of this regulation of which they have knowledge, and the inspector in charge shall report the same to the chief of bureau.

REGULATION 6. ASSIGNMENT OF BUREAU EMPLOYES

SECTION 1. The chief of bureau shall designate an inspector in charge of the inspection at each official station, and assign to said inspector such assistants as may be necessary.

SECTION 2. For the purpose of any examination or inspection, bureau employes shall have access at all times, by day or night, whether the establishment be operated or not, to every part of any official establishment to which they are assigned.

SECTION 3. Each bureau employe will be furnished with a numbered official badge which he shall not allow to leave his possession. This badge shall be sufficient identification to entitle him to admittance at all regular entrances and to all parts of the establishment and premises to which he is assigned, and to any place, at any time, for the purpose of making an inspection pursuant to section 3 of regulation 23.

SECTION 4. No bureau employe shall be detailed for duty at an establishment where any member of his family is employed by the establishment. Bureau employes are forbidden to solicit, for any one, employment at any official establishment, or by any officer, manager, or employe thereof.

REGULATION 7. FACILITIES FOR INSPECTION

SECTION 1. Office room, including light and heat, shall be provided by official establishments, rent free, for the exclusive use, for official purposes, of the inspector and other bureau employes assigned thereto. The room or rooms set apart for this purpose shall meet with the approval of the inspector in charge and shall be conveniently located, properly ventilated, and provided with lockers for protection and storage of bureau supplies and with facilities for the dressing of bureau employes.

SECTION 2. Each official establishment shall inform the inspector in charge, or his assistant, when work in each department has been concluded for the day, and of the day and hour when work will be resumed therein. Whenever any meat or product is to be overhauled or otherwise handled in an official establishment during unusual hours, the establishment shall, a reasonable time in advance, notify the inspector in charge, or his assistant, of the day and hour when such work will be commenced, and such articles shall not be so handled except after such notice has been given. No department of an official establishment shall be operated except under the supervision of a bureau employe. All slaughtering of animals and preparation of meat and products shall be done within reasonable hours, and with reasonable speed, the facilities of the establishment being considered. No shipment of any meat or product shall be made from an official establishment until after due notice has been given to the inspector in charge or his assistant.

SECTION 3. When one inspector is detailed to conduct the work at two or more official establishments where few animals are slaughtered or where but a small quantity of any meat or product is prepared, the inspector in charge may designate the hours during which such establishment may be operated.

SECTION 4. No work shall be performed at official establishments during any day on which such work is prohibited by the law of the State or Territory or District of Columbia in which the establishment is located. However, the department requires that it be judicially determined that such work is so prohibited.

SECTION 5. When required by the chief of bureau or the inspector in charge, the following facilities and conditions, and such others as may be essential to efficient conduct of inspection, shall be provided by each official establishment.

(*a*) Satisfactory pens, equipment, and assistants for conducting ante-mortem inspection and for separating, marking, and holding apart from passed animals those marked "U. S. suspect" and those marked "U. S. condemned."

(*b*) Sufficient natural light, and abundant artificial light at times of the day when natural light may not be adequate, at places for inspection. Such places shall be kept sufficiently free of steam and vapors for inspection to be properly made.

(*c*) Racks, receptacles, or other suitable devices for retaining such parts as the head, tongue, tail, thymus gland, and viscera, and all parts and blood to be used in the preparation of meat food products or medical products, until after the post-mortem examination is completed, in order that they may be identified in case of condemnation of the carcass; equipment, trucks, and receptacles for the handling of viscera of slaughtered animals so as to prevent contact with the floor; trucks, racks, marked receptacles, tables, or other necessary equipment for the separate and sanitary handling of carcasses or parts passed for sterilization.

(*d*) Tables, benches, and other equipment on which inspection is performed, of such design, material, and construction as to enable bureau employes to conduct their inspection in a ready, efficient, and cleanly manner.

(*e*) Sanitary water-tight metal trucks or receptacles for holding and handling diseased carcasses and parts; such trucks or receptacles to be marked in a conspicuous manner with the phrase "U. S. condemned," in letters not less than 2 inches high, and, when required by the inspector in charge, to be equipped with facilities for locking or sealing.

(*f*) Adequate arrangements, including disinfectants, for cleansing and disinfecting hands, for sterilizing all implements used in dressing diseased carcasses, and for disinfecting hides, floors, and such other articles and places as may be contaminated by diseased carcasses or otherwise.

(*g*) In establishments in which slaughtering is done, rooms, compartments, or specially prepared open places, to be known as "final inspection places," at which the final inspection of retained carcasses shall be conducted. Final inspection places shall be sufficient in size and their rail arrangement and other equipment shall be adequate to prevent carcasses and parts passed for food or sterilization from being contaminated by contact with condemned carcasses or parts. They shall be equipped with hot water, stationary washstands, and sanitary tables and other apparatus essential to a ready, efficient, and sanitary conduct of the inspection. The floors shall be of sanitary construction and shall have proper sewer connections, and when the final inspection place is part of a larger floor it shall be separated by a curb and railing.

(*h*) In each establishment at which any condemned article is held until a day subsequent to its condemnation, a suitably located room or compartment in which the same shall be placed. This room or compartment shall be secure, rat-proof, and susceptible of being kept clean, including a sanitary disposal of the floor liquids. It shall be equipped for secure locking, and shall be held under a lock furnished by the department, the key of which shall not leave the custody of a bureau employe. The door or doors of such room or compartment shall be conspicuously marked with the phrase "U. S. condemned," in letters not less than 2 inches high.

(*i*) Rooms, compartments, and receptacles in such number and in such locations as the needs of the inspection in the establishment may require, in which carcasses and products may be held for further inspection. These shall be equipped for secure locking and shall be held under locks furnished by the department, the keys of which shall not leave the custody of bureau employes. Every such room, compartment, or receptacle shall be conspicuously marked with the phrase "U. S. retained," in letters not less than 2 inches high.

(*j*) Adequate facilities, including denaturing materials, for the proper disposal of condemned articles in accordance with these regulations. Tanks which, under these regulations, must be sealed shall be properly equipped for sealing as may be specified by the chief of bureau.

(*k*) Docks and receiving rooms, to be designated by the establishment, with the approval of the inspector in charge, for the receipt and inspection of all meat and products as provided in section 4 of regulation 18.

(*l*) Suitable lockers in which brands bearing the inspection legend shall be kept when not in use. All such lockers shall be equipped for locking with locks to be supplied by the department, the keys of which shall not leave the custody of bureau employes.

SECTION 6. Inspectors shall furnish their own implements, such as knives, steels, and triers, for conducting inspection, and shall cleanse their hands and implements as prescribed by paragraph 3 of section 7 of regulation 8.

REGULATION 8. SANITATION

SECTION 1. Prior to the inauguration of inspection, an examination of the establishment and premises shall be made by a bureau employe and the requirements for sanitation and the necessary facilities for inspection specified.

SECTION 2. Triplicate copies of plans, properly drawn to scale, and of specifications, including plumbing and drainage, for remodeling plants of official establishments and for new structures, shall be submitted to the chief of bureau in advance of construction.

SECTION 3. *Paragraph 1.* Official establishments, establishments at which market inspection is conducted, and premises on or in which any meat or product is prepared or handled by or for persons to whom certificates of exemption have been issued, shall be maintained in sanitary condition, and to this end the requirements of paragraphs 2 to 8, inclusive, of this section shall be complied with.

Paragraph 2. There shall be abundant light, both natural and artificial, and sufficient ventilation for all rooms and compartments, to insure sanitary condition.

Paragraph 3. There shall be an efficient drainage and plumbing system for the establishment and premises, and all drains and gutters shall be properly installed with approved traps and vents.

Paragraph 4. The water supply shall be ample, clean, and potable, with adequate facilities for its distribution in the plant. Every establishment shall make known, and whenever required shall afford opportunity for inspection of, the source of its water supply and the location and character of its reservoir and storage tanks.

Paragraph 5. The floors, walls, ceilings, partitions, posts, doors, and other parts of all structures shall be of such materials, construction, and finish as will make them susceptible of being readily and thoroughly cleaned. The floors shall be kept water-tight. The rooms and compartments used for edible products shall be separate and distinct from those used for inedible products.

Paragraph 6. The rooms and compartments in which any meat or product is prepared or handled shall be free from odors from dressing and toilet rooms, catch basins, hide cellars, casing rooms, inedible tank and fertilizer rooms, and stables.

Paragraph 7. Every practicable precaution shall be taken to keep establishments free of flies, rats, mice, and other vermin. The use of rat poisons is prohibited in rooms or compartments where any unpacked meat or product is stored or handled; but their use is not forbidden in hide cellars, inedible compartments, outbuildings, or similar places, or in storerooms containing canned or tierced products. So called rat viruses shall not be used in any part of an establishment or the premises thereof.

Paragraph 8. Dogs shall not be admitted into official establishments except, upon permission of the inspector in charge, for the purpose of destroying rats. Dogs admitted shall be kept free from tape-worm infestation. Such examinations shall be made to determine freedom from infestation as the chief of bureau may prescribe. Contamination by the excreta of these animals shall not be permitted, nor shall the dogs be allowed to eat the raw viscera of cattle, sheep, swine, or goats.

SECTION 4. Adequate sanitary facilities and accommodations shall be furnished by every official establishment. Of these the following are specifically required:

(*a*) Dressing rooms, toilet rooms, and urinals, sufficient in number, ample in size, conveniently located, properly ventilated, and meeting all requirements as to sanitary construction and equipment. These shall be separate from the rooms and compartments in which meat and products are prepared, stored, or handled. Where both sexes are employed, separate facilities shall be provided.

(*b*) Modern lavatory accommodations, including running hot and cold water, soap, towels, etc. These shall be placed in or near toilet and urinal rooms and also at such other places in the establishment as may be essential to assure cleanliness of all persons handling any meat or product.

(*c*) Properly located facilities for disinfecting and cleaning utensils and hands of all persons handling any meat or product.

(*d*) Cuspidors of such shape as not readily to be upset and of such material as to be readily disinfected. They shall be sufficient in number and accessibly placed in all rooms and places designated by the inspector in charge, and all persons who expectorate shall be required to use them.

SECTION 5. Equipment and utensils used for preparing, processing, and otherwise handling any meat or product shall be of such materials and construction as will make them susceptible of being readily and thoroughly cleaned and such as will insure strict cleanliness in the preparation and handling of all meat and products. Trucks and receptacles used for inedible products shall bear some conspicuous and distinctive mark and shall not be used for handling edible products.

SECTION 6. Rooms, compartments, places, equipment, and utensils used for preparing, storing, or otherwise handling any meat or product, and all other parts of the establishment, shall be kept clean and sanitary.

SECTION 7. *Paragraph 1.* Operations and procedures involving the preparation, storing, or handling of any meat or product shall be in accord with cleanly and sanitary methods.

Paragraph 2. Rooms and compartments in which inspections are made and those in which animals are slaughtered or any meat or product is processed or prepared shall be kept sufficiently free of steam and vapors to enable bureau employes to make inspections and to insure cleanly operations. The walls and ceilings of rooms and compartments under refrigeration shall be kept reasonably free from moisture.

Paragraph 3. Butchers and others who dress or handle diseased carcasses or parts shall, before handling or dressing other carcasses or parts, cleanse their hands of grease, immerse them in a prescribed disinfectant, and rinse them in clean water. Implements used in dressing diseased carcasses shall be thoroughly cleansed in boiling water or in a prescribed disinfectant, followed by rinsing in clean water. The employes of the establishment who handle any meat or product shall keep their hands clean, and in all cases after visiting the toilet rooms or urinals shall wash their hands before handling any meat or product or implements used in the preparation of the same.

Paragraph 4. Aprons, frocks, and other outer clothing worn by persons who handle any meat or product shall be of material that is readily cleansed, and only clean garments shall be worn. Knife scabbards shall be kept clean.

Paragraph 5. Such practices as spitting on whetstones, placing skewers or knives in the mouth, inflating lungs or casings, or testing with air from the mouth such receptacles as tierces, kegs, casks, and the like, containing or intended as containers of any meat or product, are prohibited. Only mechanical means may be used for testing.

SECTION 8. The wagons and cars in which any meat or product is transported shall be kept in a clean and sanitary condition. Wagons used in transferring loose meat and products between official establishments shall be closed or so covered that the contents shall be kept clean.

SECTION 9. *Paragraph 1.* Second-hand tubs, barrels, and boxes intended for use as containers of any meat or product shall be inspected when received at the establishment and before they are cleaned. Those showing evidence of misuse rendering them unfit to serve as containers for food products shall be rejected. The use of those showing no evidence of previous misuse may be allowed after they have been thoroughly and properly cleaned. Steaming, after thorough scrubbing and rinsing, is essential to cleaning tubs and barrels.

Paragraph 2. Interiors of tank cars about to be used for the transportation of any meat food product shall be carefully inspected for cleanliness even though the last previous content was edible. Lye and soda solutions used in cleaning must be thoroughly removed by rinsing with clean water. In their examinations bureau employes shall enter the tank with a light and examine all parts of the interior.

SECTION 10. The outer premises of every official establishment, embracing docks and areas where cars and wagons are loaded, and the driveways, approaches, yards, pens, and alleys, shall be properly drained and kept in clean and orderly condition. All catch basins on the premises shall be of such construction and location and be given such attention as will insure their being kept in acceptable condition as regards odors and cleanliness. The accumulation on the premises of establishments of any material in which flies may breed, such as hog hair, bones, paunch contents, or manure, is forbidden. No nuisance shall be allowed in any establishment or on its premises.

SECTION 11. No establishment shall employ in any department where any meat or product is handled or prepared any person affected with tuberculosis or other communicable disease.

SECTION 12. When necessary, bureau employes shall attach a "U. S. rejected" tag to any equipment or utensil which is insanitary, or the use of which would be in violation of these regulations. No equipment or utensil so tagged shall again be used until made sanitary. Such tag so placed shall not be removed by any one other than a bureau employe.

REGULATION 9. ANTE-MORTEM INSPECTION

SECTION 1. *Paragraph 1.* An ante-mortem examination and inspection shall be made of all cattle, sheep, swine, and goats about to be slaughtered in an official establishment before their slaughter shall be allowed.

Paragraph 2. Such ante-mortem inspection shall be made in pens on the premises of the establishment in which the animals are about to be slaughtered, except as provided in paragraph 3 of this section.

Paragraph 3. At each official station where there are public stockyards, upon approval of the chief of bureau, ante-mortem inspection may be conducted at the scales or in the pens of the yards. Inspection under this paragraph shall be performed only on animals presented for inspection by an official establishment. Except as provided in section 7 of this regulation, every animal marked as a suspect on such inspection shall be slaughtered at an official establishment of the official station at which the inspection was made. If any such animal be not so slaughtered or disposed of in compliance with section 7 of this regulation, then thereafter no ante-mortem inspection shall be done under this paragraph for the official establishment which presented the animal for inspection, and ante-mortem inspection for that establishment shall be performed only in pens on its premises in accordance with paragraph 2 of this section. Upon the chief of bureau being satisfied at any time that inspection at scales or in pens of public stockyards is being used for speculative or other unfair or unjust purposes by an official establishment or by any one in whose behalf it presents animals for inspection under this paragraph, then he shall require ante-mortem inspection for that establishment thereafter to be made only in accordance with paragraph 2 of this section. The chief of bureau may at any time withdraw ante-mortem inspection, in whole or in part, from any public stockyards.

Paragraph 4. If an animal marked as a suspect on inspection at public stockyards be not slaughtered by the establishment by which it was presented for inspection, then such animal shall be removed from the place of inspection only under the supervision of a bureau employe, and, until slaughtered in compliance with paragraph 3 of this section or disposed of pursuant to section 7 of this regulation, shall remain under the supervision of a bureau employe. Every animal marked as a suspect on inspection in the pens of an official establishment shall be slaughtered on the premises of that establishment unless disposed of pursuant to section 7 of this regulation.

Paragraph 5. The withdrawal of ante-mortem inspection from public stockyards, in whole or in part, shall not be a substitute for, but shall be in addition to, any penalty for violating these regulations elsewhere prescribed by these regulations or prescribed by the meat inspection act.

SECTION 2. *Paragraph 1.* All animals plainly showing on ante-mortem inspection any disease or condition that under these regulations would cause condemnation of their carcasses on post-mortem inspection shall be marked "U. S. condemned" and disposed of in accordance with section 8 of this regulation.

Paragraph 2. All hogs plainly showing on ante-mortem inspection that they are affected with either hog cholera or swine plague shall be marked "U. S. condemned" and disposed of in accordance with section 8 of this regulation.

Paragraph 3. If a hog has a temperature of 106° F. or higher, and is of a lot in which there are symptoms of either hog cholera or swine plague, in case of doubt as to the cause of the high temperature, after being marked for identification, it may be held for a reasonable time, under the supervision of an inspector, for further observation and taking of temperature. Any hog so held shall be reinspected on the day it is slaughtered. If upon such reinspection, or, when not held for further observation and taking of temperature, then on the original inspection, the hog has a temperature of 106° F. or higher, it shall be condemned and disposed of in accordance with section 8 of this regulation.

Paragraph 4. All animals showing on ante-mortem inspection symptoms of rabies, tetanus, milk fever, or railroad sickness shall be marked "U. S. condemned" and disposed of in accordance with section 8 of this regulation.

Paragraph 5. Immature animals offered for ante-mortem inspection at any of the places specified in this regulation, and animals found dead or in a dying condition on premises of an official establishment, shall be marked "U. S. condemned" and disposed of in accordance with section 8 of this regulation.

Paragraph 6. All animals which, on ante-mortem inspection, do not plainly show, but are suspected of being affected with, any disease or condition that, under these regulations, may cause condemnation, in whole or in part, on post-mortem inspection, shall be so marked as to retain their identity as suspects until final post-mortem inspection, when the carcasses shall be marked and disposed of as provided elsewhere in these regulations, or until disposed of in accordance with section 7.

Paragraph 7. All seriously crippled animals and animals commonly termed "downers," if not marked "U. S. condemned" under paragraph 1, 2, 3, or 4, shall be marked and treated as suspects in accordance with paragraph 6 of this section.

Paragraph 8. Animals which are known to have reacted to the tuberculin test and which are to be slaughtered at an official establishment shall be marked and treated as suspects in accordance with paragraph 6 of this section.

SECTION 3. All animals required by these regulations to be treated as suspects, or to be marked as suspects, or to be marked so as to retain their identity as suspects, shall be marked by or under the supervision of a bureau employe "U. S. suspect," or with such other distinctive mark or marks to indicate that they are suspects as the chief of bureau may adopt. No such mark shall be removed except by a bureau employe.

SECTION 4. *Paragraph 1.* All hogs, even though not themselves marked as suspects, which are of lots one or more of which have been condemned or marked as suspects under section 2 of this regulation for either hog cholera or swine plague, shall, so far as possible, be slaughtered separately and apart from all other animals passed on ante-mortem inspection.

Paragraph 2. All animals required to be marked as suspects shall be set apart and, except as hereinafter provided, shall be slaughtered separately from other animals at an official establishment. In order to avoid unnecessary suffering, crippled animals and animals commonly termed "downers" should be slaughtered without delay.

Section 5. In all cases of emergency slaughter, except as provided in section 23 of regulation 11, the animals shall be inspected immediately before slaughter, whether theretofore inspected or not. When the necessity for emergency slaughter exists the establishment shall notify the inspector in charge or his assistant so that such inspection may be made.

Section 6. *Paragraph 1.* When any condition is suspected in which the question of temperature is important, such as hog cholera, swine plague, Texas fever, anthrax, blackleg, pneumonia, or septicemia, and in the case of animals commonly termed "downers," the exact temperature shall be taken and recorded.

Paragraph 2. If any animal has a temperature indicating a diseased condition, in case of doubt as to the cause of the high temperature, after being marked for identification, it may be held for a reasonable time, under the supervision of an inspector, for further observation and taking of temperature, before its final disposal is determined.

Section 7. *Paragraph 1.* The slaughter of an animal which has been marked as a suspect on account of pregnancy or on account of having recently given birth to young, and which has not been exposed to any infectious or contagious disease, is not required. Such animal, together with its young, may be released for breeding or dairy purposes, and when released shall be promptly removed from the stockyards or premises of the establishment where inspected. At the time the animal is released, and immediately before removal, the suspect mark if detachable shall be detached by a bureau employe, who shall report his action to the inspector in charge.

Paragraph 2. Vaccine animals with unhealed lesions of vaccinia, accompanied by fever, which have not been exposed to any other infectious or contagious disease, are not required to be slaughtered and may be disposed of in accordance with paragraph 1 of this section.

SECTION 8. Animals marked "U. S. condemned" shall be killed by the establishment, if not already dead, and shall not be taken into an establishment to be slaughtered or dressed, nor shall they be conveyed into any department of the establishment used for edible products, but they shall be disposed of and tanked in the manner provided for condemned carcasses in regulation 14. The "U. S. condemned" tag shall not be removed from, but shall remain on, the animal when it goes into the tank. The number of such tag shall be reported to the inspector in charge by the bureau employe who affixed it and also by the bureau employe who supervises the tanking of the animal.

REGULATION 10. POST-MORTEM INSPECTION

SECTION 1. A careful post-mortem examination and inspection shall be made of the carcasses and parts thereof of all cattle, sheep, swine, and goats slaughtered at official establishments. Such inspection and examination shall be made at the time of slaughter, except in cases of emergencies provided for in section 23 of regulation 11.

SECTION 2. The head, tongue, tail, thymus gland, and all viscera, and all parts and blood to be used in the preparation of meat food products or medical products, shall be held in such manner as to preserve their identity until after post-mortem examination has been completed, in order that they may be identified in case of condemnation of the carcass.

SECTION 3. *Paragraph 1.* Each carcass, including all parts and detached organs thereof, in which any lesion of disease or other condition is found that might render the meat or any organ unfit for food purposes, and which for that reason would require a subsequent inspection, shall be retained by the bureau employe at the time of inspection and taken to the place designated for final inspection. The identity of every such retained carcass, part, and detached organ thereof shall be maintained until the final inspection has been completed. Retained carcasses shall not be either washed or trimmed unless authorized by the inspector.

Paragraph 2. Such devices and methods as may be approved by the chief of bureau may be used for the temporary identification of retained carcasses, parts, or organs. In all cases the identification shall be further established by affixing "U. S. retained" tags as soon as practicable and before final inspection. These tags shall not be removed except by a bureau employe.

Section 4. Each carcass or part which is found on final inspection to be unsound, unhealthful, unwholesome, or otherwise unfit for human food shall be conspicuously marked on the surface tissues thereof by a bureau employe at the time of inspection "U. S. inspected and condemned." Condemned detached organs and parts of such character that they can not be so marked shall be immediately placed in trucks or receptacles which shall be kept plainly marked "U. S. inspected and condemned" in letters not less than 2 inches high. All condemned carcasses, parts, and organs shall remain in the custody of a bureau employe and shall be tanked as required in these regulations at or before the close of the day on which they are condemned, or be locked in the "U. S. condemned" room or compartment. Condemned articles shall not be allowed to accumulate unnecessarily in the condemned room or compartment.

Section 5. *Paragraph 1.* Carcasses and parts passed for sterilization shall be conspicuously marked on the surface tissues thereof by a bureau employe at the time of inspection "Passed for sterilization." All such carcasses and parts shall be sterilized in accordance with regulation 15 and until so sterilized shall remain in the custody of a bureau employe.

Paragraph 2. In all cases where carcasses showing localized lesions of disease are passed for food or for sterilization the diseased parts shall be removed before the "U. S. retained" tag is taken from the carcass, and such parts shall be condemned.

Section 6. Carcasses and parts found to be sound, healthful, wholesome, and fit for human food shall be passed and marked as provided in these regulations.

Section 7. Hog carcasses found before evisceration to be affected with an infectious or contagious disease, including tuberculosis, shall not be eviscerated at the regular killing bed or bench, but shall be retained and separated from other carcasses and taken to the final inspection room or place and there opened and examined. This requirement, however, may be waived for those slaughter floors where the number of animals slaughtered per hour is small and on which the inspection facilities are such as permit a ready, efficient, and sanitary performance of the final inspection without such separation.

SECTION 8. *Paragraph 1.* When a carcass is to be dressed with the skin or hide left on, the skin or hide shall be thoroughly washed and cleaned before evisceration.

Paragraph 2. All hair, scurf, and dirt shall be removed from hog carcasses, and the carcasses thoroughly washed and cleaned, before any incision is made for inspection or evisceration.

Paragraph 3. Skins and hides from animals condemned for tuberculosis or any disease communicable to man or other animal may be removed from the establishment, except as provided in section 2 of regulation 11, for tanning or other industrial use; but they shall be removed for these uses only after disinfection as follows: Each skin or hide shall be immersed for not less than 5 minutes in a 5 per cent. solution of liquor cresolis compositus, or a 5 per cent. solution of carbolic acid. The process of skinning and dipping shall be conducted entirely in the retaining room, or other specially prepared place approved by the inspector in charge, and under the supervision of a bureau employe.

SECTION 9. The sternum of each carcass shall be split and spread apart at the time of slaughter so as to expose lungs, heart, liver, and thoracic cavity, to allow inspection and drainage.

SECTION 10. Carcasses or parts of carcasses shall not be inflated with air. Transferring the caul or other fat from fat to lean carcasses is prohibited.

SECTION 11. When only a portion of a carcass is to be condemned on account of slight bruises, either the bruised portion shall be removed immediately and tanked or the carcass shall be immediately placed in a retaining room and kept until chilled and the bruised portion then removed and tanked.

REGULATION 11. DISPOSAL OF DISEASED CARCASSES AND PARTS

SECTION 1. The carcasses or parts of carcasses of all animals slaughtered at an official establishment and found at the time of slaughter or at any subsequent inspection to be affected with any of the diseases or conditions named in other sections of this regulation shall be disposed of according to the section of this regulation pertaining to the disease or condition. Owing to the fact that it is impracticable to formulate rules covering every case and to designate at just what stage a process becomes loathsome or a disease noxious, the decision as to the disposal of all carcasses, parts, or organs not specifically covered by these regulations shall be left to the inspector in charge.

SECTION 2. All parts, including hides, hoofs, horns, viscera, intestinal contents, fat, and blood, of animals the carcasses of which show lesions of anthrax, regardless of the extent of the disease, shall be condemned and immediately incinerated or otherwise completely destroyed. The killing bed upon which the animal was slaughtered shall be disinfected with a 1 to 1,000 solution of bichloride of mercury, and all knives, saws, and other instruments which have come in contact with the carcass shall be treated as provided in paragraph 3 of section 7 of regulation 8 before being used upon another carcass.

SECTION 3. *Paragraph 1.* The following principles are declared for guidance in passing on carcasses affected with tuberculosis:

Principle A. No meat should be used for food if it contains tubercle bacilli, or if there is a reasonable possibility that it may contain tubercle bacilli, or if it is impregnated with toxic substance of tuberculosis or associated septic infections.

Principle B. Meat should not be destroyed if the lesions are localized and not numerous, if there is no evidence of distribution of tubercle bacilli through the blood or by other means to the muscles or to parts that may be eaten with the muscles, and if the animal is well nourished and in good condition, since in this case there is no proof, or even reason to suspect, that the flesh is unwholesome.

Principle C. Evidences of generalized tuberculosis are to be sought in such distribution and number of tuberculous lesions as can be explained only upon the supposition of the entrance of tubercle bacilli in considerable number into the systemic circulation. Significant of such generalization is the presence of numerous uniformly distributed tubercles throughout both lungs, also tubercles in the spleen, kidneys, bones, joints, and sexual glands, and in the lymph glands connected with these organs and parts, or in the splenic, renal, prescapular, popliteal, and inguinal glands, when several of these organs and parts are coincidentally affected.

Principle D. Localized tuberculosis is tuberculosis limited to a single or several parts or organs of the body without evidence of recent invasion of numerous bacilli into the systemic circulation.

Paragraph 2. The meat of animals affected with tuberculosis shall be disposed of as follows:

Rule A. The entire carcass shall be condemned if any of the following conditions occur:

(*a*) When it was observed before the animal was killed that it was suffering with fever.

(*b*) When there is a tuberculous or other cachexia, as shown by anemia and emaciation.

(*c*) When the lesions of tuberculosis are generalized, as shown by their presence not only at the usual seats of primary infection but also in parts of the carcass or in the organs that may be reached by the bacilli of tuberculosis only when they are carried in the systemic circulation. Tuberculous lesions in any two of the following mentioned organs are to be accepted as evidence of generalization when they occur in addition to local tuberculous lesions in the digestive or respiratory tracts, including the lymph glands connected therewith: Spleen, kidney, uterus, udder, ovary, testicle, adrenal gland, and brain or spinal cord or their membranes. Numerous tubercles uniformly distributed throughout both lungs also afford evidence of generalization.

(*d*) When the lesions of tuberculosis are found in the muscles or intermuscular tissue or bones or joints, or in the body lymph glands as a result of draining the muscles, bones, or joints.

(*e*) When the lesions are extensive in one or both body cavities.

(*f*) When the lesions are multiple, acute, and actively progressive. (Evidence of active progress consists in signs of acute inflammation about the lesions, or liquefaction necrosis, or the presence of young tubercles.)

Rule B. An organ or a part of a carcass shall be condemned under any of the following conditions:

(*a*) When it contains lesions of tuberculosis.

(*b*) When the lesion is localized but immediately adjacent to the flesh, as in the case of tuberculosis of the parietal pleura or peritoneum. In this case not only the membrane or part affected but also the adjacent thoracic or abdominal wall is to be condemned.

(*c*) When it has been contaminated by tuberculous material by contact with the floor or a soiled knife or otherwise.

(*d*) Heads showing lesions of tuberculosis shall be condemned, except that when the heads of hogs are from carcasses passed for food or for sterilization and the lesions are slight, are calcified or encapsulated, and are confined to lymph glands in which not more than two glands are involved, the head may be passed for sterilization after the diseased tissues have been removed and condemned.

(*e*) An organ shall be condemned when the corresponding lymph gland is tuberculous.

Rule C. Carcasses showing lesions of tuberculosis should be passed for food when the lesions are slight, localized, and calcified or encapsulated, or are limited to a single or several parts or organs of the body (except as noted in Rule A), and there is no evidence of recent invasion of tubercle bacilli into the systemic circulation. Under this rule carcasses showing such lesions as the following may be passed, after the parts containing the lesions are removed and condemned in accordance with Rule B:

(*a*) In the cervical lymph glands and two groups of visceral lymph glands in a single body cavity, such as the cervical, bronchial, and mediastinal glands, or the cervical, hepatic, and mesenteric glands.

(*b*) In the cervical lymph glands and one group of visceral lymph glands and one organ in a single body cavity, such as the cervical and bronchial glands and the lungs, or the cervical and hepatic glands and the liver.

(*c*) In two groups of visceral lymph glands and one organ in a single body cavity, such as the bronchial and mediastinal glands and the lungs, or the hepatic and mesenteric glands and the liver.

(*d*) In two groups of visceral lymph glands in the thoracic cavity and one group in the abdominal cavity, or in one group of visceral lymph glands in the thoracic cavity and two groups in the abdominal cavity, such as the bronchial, mediastinal, and hepatic glands, or the bronchial, hepatic, and mesenteric glands.

(*e*) In the cervical lymph glands and one group of visceral lymph glands in each body cavity, such as the cervical, bronchial, and hepatic glands.

(*f*) In the cervical lymph glands and one group of visceral lymph glands in each body cavity, together with the liver when the latter contains but few localized foci. In this class of carcasses, which will be chiefly those of hogs, the lesions of the liver are considered to be primary, as the disease is practically always of alimentary origin.

Rule D. Carcasses which reveal lesions more severe or more numerous than those described for carcasses to be passed (Rule C), but not so severe nor so numerous as the lesions described for carcasses to be condemned (Rule A), may be rendered into lard or tallow or otherwise sterilized in accordance with regulation 15, if the distribution of the lesions is such that all parts containing tuberculous lesions can be removed.

SECTION 4. *Paragraph 1.* The carcasses of all hogs marked as suspects on ante-mortem inspection shall be given careful post-mortem inspection, and if it appears that they are affected with either acute hog cholera or swine plague, they shall be condemned.

Paragraph 2. Carcasses of hogs which show acute and characteristic lesions of either hog cholera or swine plague in any organ or tissue, other than the kidneys or lymph glands, shall be condemned. Inasmuch as lesions resembling lesions of hog cholera or swine plague occur in the kidneys and lymph glands of hogs not affected with either hog cholera or swine plague, carcasses of hogs in the kidneys or lymph glands of which appear any lesions resembling lesions of either hog cholera or swine plague shall be carefully further inspected for corroborative lesions. On such further inspection—

(*a*) If the carcass shows such lesions in the kidneys or in the lymph glands or in both, accompanied by characteristic lesions in some other organ or tissue, then all lesions shall be regarded as those of hog cholera or swine plague, and the carcass shall be condemned.

(*b*) If the carcass shows in any organ or tissue, other than the kidneys or lymph glands, lesions of either hog cholera or swine plague, which are slight and limited in extent, it shall be passed for sterilization in accordance with regulation 15.

(*c*) If the carcass shows no indication of either hog cholera or swine plague in any organ or tissue other than the kidneys or lymph glands, it shall be passed for food, unless some other provision of these regulations requires a different disposal.

SECTION 5. *Paragraph 1.* Carcasses of animals showing generalized actinomycosis shall be condemned.

Paragraph 2. Carcasses of animals in a well-nourished condition showing uncomplicated localized actinomycotic lesions may be passed after the infected organs or parts have been removed and condemned, except as provided in paragraph 3 of this section.

Paragraph 3. Heads affected with actinomycosis (lumpy jaw), including the tongue, shall be condemned, except that when the disease of the jaw is slight, strictly localized, and without suppuration, fistulous tracts, or lymph-gland involvement, the tongue, if free from disease, may be passed.

SECTION 6. Carcasses of animals affected with, or showing lesions of, any of the following named diseases or conditions shall be condemned:

(*a*) Blackleg.
(*b*) Hemorrhagic septicemia.
(*c*) Pyemia.
(*d*) Septicemia.
(*e*) Texas fever.
(*f*) Malignant epizootic catarrh.
(*g*) Unhealed vaccine lesions.
(*h*) Parasitic ictero-hematuria in sheep.

SECTION 7. Any individual organ or part of a carcass affected with carcinoma or sarcoma shall be condemned. In case the carcinoma or sarcoma involves any internal organ to a marked extent, or affects the muscles, skeleton, or body lymph glands, even primarily, the carcass shall be condemned. In case of metastasis to any other organ or part of a carcass, or if metastasis has not occurred but there are present secondary changes in the muscles (serous infiltration, flabbiness, or the like), the carcass shall be condemned.

SECTION 8. Carcasses of animals showing any disease such as generalized melanosis, pseudo-leukemia, and the like, which affects the system of the animal, shall be condemned.

SECTION 9. All slight, well limited abrasions on the tongue and inner surface of the lips and mouth, when without lymph-gland involvement, shall be carefully excised, leaving only sound, normal tissue, which may be passed. Any organ or part of a carcass which is badly bruised or which is affected by a tumor, an abscess, or a suppurating sore, shall be condemned; and when the lesions are of such character or extent as to affect the whole carcass, the whole carcass shall be condemned. Parts of carcasses which are contaminated by pus shall be condemned.

SECTION 10. All carcasses of animals so infected that consumption of the meat or meat food products thereof may give rise to meat poisoning shall be condemned. This includes all carcasses showing signs of either—

(*a*) Acute inflammation of the lungs, pleura, pericardium, peritoneum, or meninges.

(*b*) Septicemia or pyemia, whether puerperal, traumatic, or without any evident cause.

(*c*) Gangrenous or severe hemorrhagic enteritis or gastritis.

(*d*) Acute diffuse metritis or mammitis.

(*e*) Polyarthritis.

(*f*) Phlebitis of the umbilical veins.

(*g*) Traumatic pericarditis.

(*h*) Any acute inflammation, abscess, or suppurating sore, if associated with acute nephritis, fatty and degenerated liver, swollen soft spleen, marked pulmonary hyperemia, general swelling of lymph glands, or diffuse redness of the skin, either singly or in combination.

Immediately after the slaughter of any animal so diseased, the premises and implements used shall be thoroughly disinfected as prescribed elsewhere in these regulations. The part of any carcass coming into contact with the carcass or any part of the carcass of any animal covered by this section, other than those affected with the diseases mentioned in (*a*) above, or with the place where such diseased animal was slaughtered, or with the implements used in the slaughter thereof, before thorough disinfection of such place and implements has been accomplished, or with any other contaminated object, shall be condemned. In case the contaminated part is not removed from the carcass within 2 hours after such contact the whole carcass shall be condemned.

Section 11. From the standpoint of meat inspection, necrobacillosis (lip-and-leg ulceration) may be regarded as a local affection at the beginning, and carcasses in which the lesions are so localized may be passed for food if in a good state of nutrition, after removing and condemning those portions affected with necrotic lesions. On the other hand, when emaciation, cloudy swelling of the glandular organs, or enlargement and discoloration of the lymph glands are associated with the affection, it is evident that the disease has progressed beyond the condition of localization to a state of toxemia, and the entire carcass should therefore be condemned as both innutritious and noxious. Septicemia or pyemia may intervene as a complication of the local necrosis, and when present the carcass shall be condemned in accordance with section 6 (*c, d*) of this regulation.

SECTION 12. When extensive lesions of caseous lymphadenitis, with or without pleuritic adhesions, are found in the lungs, or if several of the visceral organs contain caseous nodules and the carcass is emaciated, the carcass shall be condemned. When the lesions of caseous lymphadenitis are limited to the superficial glands or to a few nodules in an organ, involving also the adjacent lymph glands, and the carcass is well nourished, the meat may be passed after the affected parts are removed and condemned.

SECTION 13. Carcasses showing any degree of icterus with a parenchymatous degeneration of organs, the result of infection or intoxication, and those which show an intense yellow or greenish yellow discoloration without evidence of infection or intoxication, shall be condemned. Carcasses affected with icterus, the result of conditions other than those before stated in this section, but which lose such discoloration on chilling, shall be passed for food, while those which do not so lose such discoloration may be passed for sterilization. No carcass affected with icterus may be passed for food or for sterilization unless the final inspection thereof is completed under natural light.

SECTION 14. Carcasses which give off the odor of urine or a sexual odor shall be condemned. When the final inspection of such carcasses is deferred until they have been chilled, the disposal shall be determined by the heating test.

SECTION 15. *Paragraph 1.* Carcasses of animals affected with mange or scab in advanced stages, or showing emaciation or extension of the inflammation to the flesh, shall be condemned. When the disease is slight, the carcass may be passed.

Paragraph 2. Carcasses of hogs affected with urticaria (diamond skin disease), *Tinea tonsurans, Demodex folliculorum,* or erythema may be passed after detaching the affected skin, if the carcass is otherwise fit for food.

SECTION 16. *Paragraph 1.* Carcasses of cattle (including the viscera) infested with tapeworm cysts known as *Cysticercus bovis* shall be condemned if the infestation is excessive or if the meat is watery or discolored. Carcasses shall be considered excessively infested if incisions in various parts of the musculature expose on most of the cut surfaces two or more cysts within an area the size of the palm of the hand.

Paragraph 2. Carcasses of cattle showing a slight infestation, that is, not to exceed ten cysts, as determined by a careful examination of the heart, muscles of mastication, tongue, diaphragm and its pillars, and of portions of the carcass rendered visible by the process of dressing, may be passed for food after removal and condemnation of the cysts, with the surrounding tissues, provided the carcasses and parts, appropriately identified by retained tags, are held in cold storage or pickle for not less than 21 days under conditions which will insure proper preservation; and provided, further, that if the temperature at which such carcasses and parts are held in cold storage does not exceed 15° F., the period of retention may be reduced to 6 days. Carcasses which show no cysts except in the heart may be passed for food after retention in cold storage or pickle as above provided, irrespective of the number of cysts in the heart.

Paragraph 3. Carcasses of cattle showing a moderate infestation, that is, a greater number of cysts than mentioned in paragraph 2, but which are not so extensively infested as indicated in paragraph 1, of this section, may be passed for sterilization. In case such carcasses are not sterilized as required by regulation 15, they shall be condemned.

Paragraph 4. Fats of carcasses passed for food or for sterilization under the provisions of paragraphs 2 and 3 may be passed for food provided they are melted at a temperature of not less than 140° F. The edible viscera, except the lungs and heart, of carcasses passed for food or for sterilization under the provisions of paragraphs 2 and 3 may be passed for food without refrigeration or other process of sterilization provided they are found to be free from infestation upon final inspection. The intestines, weasands, and bladders from beef carcasses affected with *Cysticercus bovis* which have been passed for food or for sterilization may be used for casings after they have been subjected to the usual methods of preparation and may be passed for such purpose upon completion of the final inspection.

Paragraph 5. The inspection for *Cysticercus bovis* may be omitted in the case of calves under 6 weeks old. The routine inspection of calves over 6 weeks old for *Cysticercus bovis* may be limited to a careful examination of the surface of the heart and such surfaces of the body musculature as are rendered visible by the process of dressing.

SECTION 17. Carcasses of hogs affected with tapeworm cysts (*Cysticercus cellulosæ*) may be passed for sterilization, but if the infestation is excessive the carcass shall be condemned.

SECTION 18. *Paragraph 1.* In the disposal of carcasses, edible organs, and parts of carcasses showing evidence of infestation with parasites not transmissible to man, the following general rules shall govern: If the lesions are localized in such a manner and are of such a character that the parasites and the lesions caused by them may be radically removed, the nonaffected portion of the carcass, organ, or part of the carcass may be passed for food after the removal and condemnation of the affected portions. If an organ or a part of a carcass shows numerous lesions caused by parasites, or if the character of the infestation is such that complete extirpation of the parasites and lesions is difficult and uncertainly accomplished, or if the parasitic infestation or invasion renders the organ or part in any way unfit for food, the affected organ or part shall be condemned. If parasites are found to be distributed in a carcass in such a manner or to be of such a character that their removal and the removal of the lesions caused by them are impracticable, no part of the carcass shall be passed for food. If the infestation is excessive the carcass shall be condemned. If the infestation is moderate the carcass may be passed for sterilization, but in case such carcass is not sterilized as required by regulation 15 it shall be condemned.

Paragraph 2. In the case of sheep carcasses affected with tapeworm cysts located in the muscles (*Cysticercus ovis*, so-called sheep measles, not transmissible to man) the carcass may be passed after the removal and condemnation of the affected portions; provided, however, that if upon the final inspection of sheep carcasses retained on account of measles the total number of cysts found embedded in muscle or in immediate relation with muscular tissue, including the heart, exceeds five, this shall be taken to indicate that the cysts are so generally distributed and so numerous that their removal would be impracticable, and the entire carcass shall be condemned or passed for sterilization, according to the degree of infestation. If not to exceed five cysts are found the carcass may be passed after the removal and condemnation of the affected portions.

Paragraph 3. Carcasses of animals found infested with gid bladder worms (*Cœnurus cerebralis, Multiceps multiceps*) may be passed after condemnation of the affected organ (brain or spinal cord).

Paragraph 4. Organs or parts of carcasses infested with hydatid cysts (*Echinococcus*) shall be condemned.

Paragraph 5. Livers infested with flukes shall be condemned.

Section 19. Carcasses of animals too emaciated or anemic to produce wholesome meat, and carcasses which show a slimy degeneration of the fat or a serous infiltration of the muscles, shall be condemned.

Section 20. Carcasses of animals in advanced stages of pregnancy (showing signs of parturition), also carcasses of animals which have within 10 days given birth to young and in which there is no evidence of septic infection, may be passed for sterilization; otherwise, they shall be condemned.

Section 21. *Paragraph 1.* Carcasses of calves, pigs, kids, and lambs too immature to produce wholesome meat shall be condemned. Such carcasses shall be considered too immature to produce wholesome meat if (*a*) the meat has the appearance of being water-soaked, is loose, flabby, tears easily, and can be perforated with the fingers; or (*b*) its color is grayish red; or (*c*) good muscular development as a whole is lacking, especially noticeable on the upper shank of the leg, where small amounts of serous infiltrates or small edematous patches are sometimes present between the muscles; or (*d*) the tissue which later develops as the fat capsule of the kidneys is edematous, dirty yellow or grayish red, tough, and intermixed with islands of fat.

Paragraph 2. All unborn and stillborn animals shall be condemned.

Paragraph 3. Meat and organs such as lungs and livers which have been condemned on account of parasitic infestation or invasion, and the flesh of immature and unborn animals and of animals which have been condemned on account of emaciation and recent parturition, may be utilized at official establishments in the manufacture of poultry feed, provided that such organs or tissues are sterilized by thorough cooking, steam rendering, or desiccation under high temperature. If so utilized, such organs and tissues shall be handled and prepared in rooms or places separate and apart from those in which edible products are handled, prepared, or stored.

SECTION 22. Hogs that have entered the scalding vat alive or that have been suffocated in any way shall be condemned.

SECTION 23. When it is necessary for humane reasons to slaughter an injured animal at night or on Sunday or a holiday when the inspector can not be obtained, the carcass and all parts shall be kept for inspection, with the head and all viscera except the stomach, bladder, and intestines held by the natural attachments. If all parts are not so kept for inspection, the carcass shall be condemned. If on inspection of a carcass slaughtered in the absence of an inspector any lesion or condition is found indicating that the animal was sick or diseased, the carcass shall be condemned.

REGULATION 12. CARCASSES OF ANIMALS SLAUGHTERED WITHOUT ANTE-MORTEM INSPECTION

SECTION 1. No carcass of an animal slaughtered in the United States which has not had ante-mortem inspection by a bureau employe shall be brought into an official establishment, except that carcasses of cattle, sheep, swine, and goats, slaughtered by a farmer on the farm, to which the head and all viscera other than the stomach, bladder, and intestines, are held by the natural attachments, may be received for inspection at official establishments where there is a veterinary inspector, upon the conditions prescribed in this section. After receipt in an official establishment, every such carcass shall be inspected, and if found to be free from disease and otherwise sound, healthful, wholesome, and fit for human food, it shall be marked with the inspection legend. If found to be diseased, unsound, unhealthful, unwholesome, or otherwise unfit for human food, it shall be marked "U. S. inspected and condemned" and destroyed for food purposes as provided in regulation 14.

REGULATION 13. TANK ROOMS AND TANKS

SECTION 1. All tanks and equipment used for rendering or preparing inedible products shall be in rooms or compartments separate from those used for rendering or preparing edible products. There shall be no connection, by means of pipes or otherwise, between tanks, rooms, or compartments containing inedible products and those containing edible products.

SECTION 2. Every official establishment shall file with the department blue prints or other accurate diagrams showing all underground pipe lines and other equipment used to convey edible products and those used to convey inedible products, with a description giving the exact location, terminals, and dimensions of such pipes and other equipment and of all gates, valves, or other controlling apparatus, and designating the lines used for conveying edible products and those used for conveying inedible products, and shall also file a copy thereof with the inspector in charge. Like prints or diagrams of alterations in existing tank rooms or tanks and of new tank room or tanks of official establishments shall be furnished to the department and approved by the chief of bureau before the same are constructed. If no such underground pipe line or equipment is used for any of the purposes mentioned in this section, a written statement certifying to that fact and duly signed by the proprietor or operator of the establishment shall be filed with the department.

SECTION 3. *Paragraph 1.* In conveying to the inedible-product tank carcasses of animals which have been condemned on ante-mortem inspection, they shall not be taken through rooms or compartments in which any meat or product is prepared, handled, or stored.

Paragraph 2. Under no circumstances shall the carcass of any animal which has died otherwise than by slaughter be brought into any room or compartment in which any meat or product is prepared, handled, or stored.

Paragraph 3. No dead animal shall, under any circumstances, be brought from outside the premises of an official establishment into any room or compartment thereof where any meat or product is prepared; nor, unless permission therefor in advance shall be obtained from the Secretary of Agriculture, shall any dead animal be brought into rooms or compartments where inedible products are prepared. "Dead animal," within the meaning of this paragraph, shall include any animal which died without having been inspected under these regulations.

Paragraph 4. Inedible fats from outside the premises of an official establishment shall not be received except into the tank room provided for inedible products, and then only when their receipt into the tank room produces no insanitary condition on the premises. When so received, they shall not enter any room or compartment used for edible products.

REGULATION 14. TANKING AND DENATURING CONDEMNED CARCASSES AND PRODUCTS

SECTION 1. *Paragraph 1.* Condemned meat and products at official establishments having facilities for tanking shall, except as hereinafter provided, be disposed of by tanking as follows: The lower opening of the tank shall first be securely sealed by a bureau employe; then the condemned meat and products and a sufficient quantity of coloring matter or other substance to be designated by the department shall be placed in the tank in his presence, after which the upper opening shall also be securely sealed by such employe, who shall then see that a sufficient force of steam (not less than 40 pounds) is turned into the tank and maintained a sufficient time effectually to destroy the contents for food purposes.

Paragraph 2. The seals of tanks shall be broken only by a bureau employe, after the product has been rendered as provided in paragraph 1 of this section. The drawing off of the contents of such tanks shall be supervised by a bureau employe. Samples shall be taken by bureau employes as often as required to determine whether the fat or grease is effectively denatured.

Paragraph 3. Rendered fats and greases condemned on reinspection shall be destroyed for food purposes by denaturing with coloring matter or other designated substance.

SECTION 2. Any meat or product condemned at an official establishment which has no facilities for tanking shall, under the supervision of a bureau employe, be denatured with crude carbolic acid or other prescribed agent, or destroyed by incineration. When such meat or product is not incinerated, all containers thereof shall be opened, and all meat shall be freely slashed with a knife, before the denaturing agent is applied.

REGULATION 15. RENDERING CARCASSES AND PARTS INTO LARD AND TALLOW, AND OTHER STERILIZATION

SECTION 1. Carcasses and parts passed for sterilization may be rendered into lard or tallow provided that such rendering is done in the following manner: The lower opening of the tank shall first be securely sealed by a bureau employe, then the carcasses or parts shall be placed in the tank in his presence, after which the upper opening shall be securely sealed by such employe, who shall then see that a sufficient force of steam is turned into the tank. Such carcasses and parts shall be cooked at a temperature not lower than 220° F. for a time sufficient to render them effectually into lard or tallow.

SECTION 2. Establishments not equipped with steaming tanks for rendering carcasses and parts into lard or tallow as provided in section 1 of this regulation may render such carcasses or parts in open kettles under the direct supervision of a bureau employe. Such rendering shall be done at a temperature and for a time sufficient to render the carcasses and parts effectually into lard or tallow, and shall be done only during regular hours of work.

SECTION 3. *Paragraph 1.* Carcasses and parts passed for sterilization and which are not rendered into lard or tallow may be utilized for food purposes provided they are first sterilized by methods, and handled and marked in a manner, approved by the chief of bureau.

Paragraph 2. Any carcasses or parts prepared in compliance with paragraph 1 of this section may be canned if the container be plainly and conspicuously marked so as to show that the product is second grade, class, or quality and has been sterilized.

REGULATION 16. MARKING, BRANDING, AND IDENTIFYING MEAT AND PRODUCTS

SECTION 1. *Paragraph 1.* The chief of bureau may approve and authorize the use of abbreviations of marks of inspection under these regulations. Such abbreviations shall have the same force and effect as the respective marks for which they are so authorized to be used.

Paragraph 2. Except for the purpose of submitting a sample or samples of the same to the chief of bureau for approval, no person shall make or prepare, or cause to be made or prepared, the inspection legend, or any abbreviation, copy, or representation thereof, without the written authority therefor of the chief of bureau given in advance.

Paragraph 3. No person shall affix or place, or cause to be affixed or placed, the inspection legend, or any abbreviation, copy, or representation thereof, to or on any meat or product, except under the supervision of a bureau employe.

Paragraph 4. No person shall fill or cause to be filled, in whole or in part, with any meat or product, any container bearing, or, within the United States, any container intended to bear, the inspection legend, or any abbreviation, copy, or representation thereof, except under the supervision of a bureau employe.

Paragraph 5. No person shall affix or place, or cause to be affixed or placed, the inspection legend, or any abbreviation, copy, or representation thereof, to or on any container of any meat or product, except under the supervision of a bureau employe.

Paragraph 6. No person shall make, prepare, affix, or use, or cause to be made, prepared, affixed, or used, the inspection legend, or any abbreviation, copy, or representation thereof, except in compliance with these regulations.

Paragraph 7. Advertisements, photographs, and other representations of any meat or product prepared exclusively in official establishments, which contain copies or reproductions of the inspection legend and which are not false or misleading, may be permitted when approved in advance by the chief of bureau.

Paragraph 8. All marks of inspection shall be carefully applied and securely affixed.

Paragraph 9. No person shall remove or cause to be removed from an official establishment any article which these regulations require to be marked in any way unless the same is clearly and legibly marked in compliance with these regulations.

SECTION 2. *Paragraph 1.* Each carcass which has been inspected and passed in an official establishment shall be marked at the time of inspection with the inspection legend and with the number of the establishment. Each primal part shall be likewise marked before it leaves the establishment in which it is first inspected and passed, except as provided in paragraphs 2 and 6 of this section and section 6 of regulation 25.

Paragraph 2. Primal parts which have been inspected and passed but do not bear the inspection legend may be transported from one official establishment to another official establishment, for further processing, in a car, wagon, or other closed container, if the car, wagon, or container be sealed with a department seal bearing the inspection legend in compliance with these regulations.

Paragraph 3. All primal parts which have been inspected and passed shall, after processing, bear, plainly and legibly, the inspection legend and the number of the official establishment at which the processing was completed.

Paragraph 4. Inspected and passed sausages and other meat food products in animal casings, of the ordinary "ring" variety or larger, shall bear on the casings the inspection legend and the number of the establishment. Inspected and passed smoked sausages and other meat food products in animal casings, of the smaller varieties, such as Frankfort and Vienna styles, shall bear on the casings one or more marks to each chain or two or more marks to each bunch. When additional markings are required by these regulations, they shall be likewise applied.

Paragraph 5. Meat food products in animal casings, other than sausage, shall be branded with the name of the product, the statement "composed of," and the names of the ingredients arranged in the order of their percentages.

Paragraph 6. Any meat or product of such character or so small that it can not be marked with a brand, and which has been inspected and passed, but does not bear the inspection legend, may be transported in a closed container bearing the inspection legend and other marks required by these regulations. When such container has been opened, the contents thereof may not be further transported in interstate or foreign commerce unless reinspected and packed in a container or containers bearing the inspection legend and other marks required by these regulations. The chief of bureau may authorize meat and products of such character or so small that they can not be marked with a brand, which have been inspected and passed, but do not bear the inspection legend, to be removed from an official establishment in open containers when such articles have been sold by the establishment exclusively for consumption in the city or town at or in which the establishment is located. The chief of bureau may withdraw such privilege of removal in open containers if the same be in any way abused or if the establishment make any sale of any meat or product which is unsound, unhealthful, unwholesome, or otherwise unfit for human food.

SECTION 3. *Paragraph 1.* When cereal not in excess of 2 per cent. is added to sausage, the product shall be marked with the phrase "cereal added." When water in excess of 3 per cent. and cereal are added to certain kinds of sausage, as provided in paragraphs 4 and 5 of section 6 of regulation 18, the product shall be marked "sausage, water, and cereal." When water, but no cereal, is added to certain kinds of sausage, as provided in paragraph 5 of section 6 of regulation 18, the addition of water need not be stated.

Paragraph 2. When coloring matter is used in the preparation of casings, as provided in paragraph 3 of section 6 of regulation 18, the product shall be marked with the phrase "artificially colored."

SECTION 4. Official establishments shall furnish such ink brands, burning brands, and like devices for marking meat and products as the chief of bureau may require. In advance of manufacture, complete and accurate descriptions and designs of the same shall be submitted to and approved by the chief of bureau. Every such brand and device which bears the inspection legend shall, immediately upon being manufactured, be delivered into the custody of the inspector in charge of the establishment, and shall be used only under the supervision of a bureau employe. When not in use for marking inspected and passed meat and products, all such brands and devices bearing the inspection legend shall be kept locked in properly equipped lockers or compartments, the keys of which shall not leave the possession of a bureau employe.

Section 5. All brands and devices furnished by the bureau for marking articles with the inspection legend, including self-locking seals and presses for lead and wire seals, shall be used only under the supervision of a bureau employe, and, when not in use for marking, shall be kept locked in properly equipped lockers or compartments, the keys of which shall not leave the possession of a bureau employe.

Section 6. No brand or device shall be false or misleading. The letters and figures thereon shall be of such style and type as will make a clear impression. The inspection legend and establishment number on brands shall be separate and apart from trade names, marks, or other devices.

Section 7. *Paragraph 1.* Except as provided in paragraphs 2 and 3 of this section and in section 6 of regulation 25, when any inspected and passed meat or product for domestic commerce is moved from an official establishment, or from a place having market inspection under these regulations, the shipping container shall bear a domestic meat label which has been submitted to and received the approval of the department and conforms to the following specifications: The label shall be printed with black ink on white paper of good quality, and shall be not less than $2\frac{3}{4}$ by 4 inches in size. The phrase "domestic meat label" shall be printed inside the border across one end of the label. The word "establishment" and the official number shall constitute the top line of the label and shall be printed in type of such size and style as to make them the most conspicuous part of the label. The following statement shall be printed in uniform style: "The meat or meat food product contained herein has been inspected and passed under the provisions of the act of Congress of June 30, 1906."[1] The name and address of the establishment, or the name only, may also be printed on the label, at the bottom thereof, in type of such size and style as to be less conspicuous than the establishment number. No word or statement,[1] except as permitted by this paragraph, and no picture or other advertising matter, device, or design, shall appear upon the domestic meat label, which in form and substance shall be as follows:

DOMESTIC MEAT LABEL

ESTABLISHMENT 999

THE MEAT OR MEAT FOOD PRODUCT CONTAINED HEREIN HAS BEEN INSPECTED AND PASSED UNDER THE PROVISIONS OF THE ACT OF CONGRESS OF JUNE 30, 1906.

SMITH, JONES & RANKIN,
NEW YORK, N. Y.

Paragraph 2. When any meat or product prepared in an official establishment for domestic commerce has been inspected and passed and is inclosed in a cloth wrapping as a shipping container, such wrapping shall bear the inspection legend and establishment number applied by an ink brand, except in those cases in which the inspection legend and establishment number on the articles themselves are clearly legible through the wrapping.

Paragraph 3. The use of domestic meat labels is not required on containers bearing trade labels which have been approved by the department and on which the inspection legend and establishment number appear in plain view after the package is prepared for shipment.

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[1] For further information regarding the wording of the inspection legend, see sections 2 and 3 of regulation 1.

Paragraph 4. Domestic meat labels shall be affixed to packages in the manner prescribed in paragraph 2 of section 1 of regulation 24 for affixing meat inspection stamps to export packages.

Section 8. The shipping or outside containers of meat and products for export shall be marked in compliance with sections 1 and 6 of regulation 24.

Section 9. Both ends of each container, such as tierces and tank cars, of inedible grease, inedible tallow, or other inedible rendered fat, shall be painted white and conspicuously stenciled or burned with the name of the product and the word "inedible" in letters not less than 2 inches high, or, in the case of tank cars, not less than 4 inches high.

Section 10. *Paragraph 1.* Tank cars carrying inspected and passed product between official establishments shall be equipped for sealing and be securely sealed with seals bearing the inspection legend furnished by the department and affixed by bureau employes.

Paragraph 2. Each tank car carrying inspected and passed product from an official establishment to any destination other than an official establishment shall have securely affixed thereto a label showing the true name of the product, the inspection legend, the number of the official establishment, and the date of loading. Before the car is removed from the place where it is unloaded, the carrier shall remove or obliterate such label.

Paragraph 3. When inspected and passed products for export are transferred from tank cars to other containers on boats, such transfer shall be under bureau supervision, and the containers on the boats shall be likewise labeled.

REGULATION 17. LABELING

Section 1. *Paragraph 1.* When any inspected and passed meat or product is placed or packed in any can, pot, tin, canvas, or other receptacle or covering in an official establishment, there shall be attached to such container or covering a trade label as hereinafter described.

Paragraph 2. No container or covering which bears or is to bear a trade label shall be filled, in whole or in part, except with articles which have been inspected and passed in compliance with these regulations and which are sound, healthful, wholesome, fit for human food, and strictly in accordance with the statements on the label. No such container or covering shall be filled, in whole or in part, and no trade label shall be affixed, except under the supervision of a bureau employe.

Section 2. *Paragraph 1.* Trade labels shall bear the true name of the meat or product contained in the package, and, except as provided in paragraphs 2 and 5 of this section, shall bear, in prominent letters and figures of uniform size, the phrase "U. S. inspected and passed under the act of Congress of June 30, 1906,"[1] and the number of the official establishment at which the meat or product was prepared, or, if processed, the number of the establishment at which last processed. Such labels may also bear any other statement, not false or misleading, which has been approved by the department.

Paragraph 2. Trade labels within the meaning of these regulations shall include printed, lithographed, or embossed labels, stickers, seals, wrappers, and receptacles. Metal containers on which the inspection legend is embossed may, with the approval of the department, bear the inspection legend in abbreviated form.

Paragraph 3. Stencils, box dies, inserts, tags, so-called "liners" and "circles" and like devices shall not bear the inspection legend or any abbreviation or representation thereof, nor shall any of them be used in an official establishment unless previously approved by the department.

Paragraph 4. All sealed tin containers of inspected and passed meat and products filled in an official establishment shall have embossed thereon the number of that establishment. When so marked, the establishment number may be omitted from the trade label or wrapper. Trade labels shall not be affixed to containers so as to obscure the embossed establishment number.

Paragraph 5. When any meat or product is placed in cartons, or in wrappers of paper or cloth, or in such other containers as the department may approve, the inspection legend and the establishment number may be embodied in a sticker or seal prominently displayed with the trade label, but not necessarily a part thereof. Such stickers or seals shall not be used without the approval of the department, and shall be securely affixed to the containers under the supervision of a bureau employe after an approved trade label has been affixed.

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[1] For further information regarding the wording of the inspection legend, see sections 2 and 3 of regulation 1.

Paragraph 6. No detachable device bearing the inspection legend or any abbreviation or representation thereof shall be affixed to any meat or product or the container thereof.

Section 3. *Paragraph 1.* No trade label shall be used until it has been approved in its final form by the department. Duplicates of new trade labels in the form of sketches, proofs, or photographic copies shall be submitted through the inspector in charge to the department for approval. After trade labels from approved sketches or proofs are printed, lithographed, or embossed, they shall be submitted in quadruplicate through the inspector in charge for final approval and filing.

Paragraph 2. All trade labels, whether in the form of sketches, proofs, or finished labels, which are submitted to the department for final approval, shall, when the chief of bureau shall so require, be accompanied by a statement showing the kinds and percentages of the ingredients of the product on any container of which it is desired to use the label. Approximate percentages may be given in cases where the percentages of ingredients may vary from time to time, if the limits of variations are stated.

Section 4. Trade labels shall be used only on products for which they are approved. They shall not be applied to any meat or product the container of which bears any statement that is false or misleading.

Section 5. Trade labels to be affixed to packages of any meat or product for foreign commerce may be printed in a foreign language. The inspection legend and the official establishment number shall in all cases appear thereon in English; but, in addition, may appear, literally translated, in foreign languages.

Section 6. The name of any one to whom inspection is granted may appear, without qualification, upon the label or the container of an article prepared for him by the official establishment at which he was granted inspection. When an article is prepared by an official establishment for a person other than one of those to whom inspection has been granted at that establishment, and the name of such person is to appear upon the label or container thereof, a statement shall be made on the label to the effect that the article was prepared for such person, or the term "distributer" or "distributers" or "distributed by," or other equivalent term, shall be used thereon in connection with the name of such person, or the name of such person shall be used thereon followed by the word "brand" or "style" in the same size and style of lettering as the name of such person. Whenever the name of such person appears on the label, it shall be prominently placed and lettered and shall not be used so as to be either false or misleading.

Section 7. *Paragraph 1.* No meat or product, and no container thereof, shall be labeled with any false or deceptive name; but established trade names which are usual to such articles and are not false or deceptive and which have been approved by the Secretary of Agriculture may be used.

Paragraph 2. No statement, word, picture, design, or device which conveys any false impression or gives any false indication of origin or quality shall appear on any label. For example:

(*a*) The picture of any swine shall be allowed only on labels used in connection with pork products.

(*b*) Such terms as "special," "fancy," "selected," "best," "finest," "absolutely pure," "100 per cent. pure," and the like, without qualification, shall be allowed on labels only in connection with products the quality of which justifies the use of such terms.

(*c*) Names of countries, States, and Territories, and such other geographical names as the department may approve, may be used on labels only when followed by the word "style," "type," "cut," or "brand," in the same size and style of lettering as the geographical name, unless the products for which the labels are intended are prepared in the localities named; provided that when a geographical name by reason of long usage is recognized as a generic term, indicating a certain style, type, or brand, such name may be used without the words "style," "type," or "brand," when accompanied by a statement showing the State or Territory in which the product is prepared, if prepared in a State or Territory, and showing the locality in which the product is prepared, if not prepared in a State or Territory. For example, sausage of the kind commonly known as Vienna sausage may be labeled either "Vienna style sausage" or "Vienna sausage, made in Illinois." In the the latter case the words showing the place of manufacture need not be in the same size and style of lettering as the name of the product, but shall be plain and conspicuous.

(*d*) Names indicative or imitative of distinctive types or breeds of livestock shall not be used on labels unless the products for which such labels are intended are actually derived from carcasses of animals of the type or breed specified.

(*e*) The word "ham," without any prefix indicating the species of animal from which derived, shall be used on labels only in connection with pork hams.

(*f*) The word "fresh" shall not be used on labels in connection with any meat or product the ingredients of which, in whole or in part, have undergone any process of curing.

(*g*) Such terms as "meat extract" or "extract of beef," without qualification, shall not be permitted on labels in connection with products prepared from organs or parts of the carcass other than fresh flesh. Extracts prepared entirely from parts of the carcass other than fresh flesh shall not be labeled "meat extract," but may be properly labeled with the true names of the parts from which prepared, as, for example, "liver extract." The terms "beef extract" and "extract of beef" without qualification shall be applied only to extracts of fresh beef. Extract of cured beef or of other cured meat shall be designated respectively as "extract of cured beef," "extract of cured meat" or "cured-meat extract." In the latter case the words "cured" and "meat" shall appear on one line in the same size and style of lettering and shall be connected by a hyphen. When beef extract or meat extract is mixed with extract from cured meat or extract derived from the other parts of the carcass, such mixture shall be designated as "compound meat extract," and, in addition, there shall appear on the label a statement showing the ingredients, other than fresh flesh, which have been used in preparing the extract. In the case of fluid extract the word "fluid" shall also appear on the label, as, for example, "fluid extract of beef." The word "fluid" merely indicates a lower percentage of solid matter.

(*h*) Such terms as "country," "farm," and the like, shall not be used on labels in connection with meat and products unless such meat and products are actually prepared in the country or on the farm. However, if the articles are prepared in the same way as in the country or on the farm, these terms, if qualified by the word "style" in the same size and style of lettering may be used. Sausage containing cereal shall not be labeled "country style," and lard not rendered in an open kettle shall not be designated as "country style."

(*i*) The word "leaf" shall not be used in connection with lard prepared from fat other than leaf fat.

SECTION 8. A meat food product when composed of more than one ingredient shall not bear a label with a name stating or indicating that the product is a substance which is not the principal ingredient contained therein, even though such name be an established trade name. The term "principal ingredient," as used in this section, shall be construed to mean that such ingredient is equal to or exceeds in amount the other ingredients combined, exclusive of cereal and water. If the ingredients are stated on the label, they shall appear in the order of their percentages. For example, sausage containing pork and beef shall not be labeled "pork sausage," but shall be labeled "pork and beef sausage." However, if the pork ingredient equals or exceeds 50 per cent. of the meat content, the sausage may be labeled "pork sausage, beef added." A product consisting of veal, pork, and beef shall not be labeled "veal loaf," but may be designated as "veal, pork, and beef loaf." However, if the veal ingredient is not less than 50 per cent. of the meat content of the product, the product may be labeled "veal loaf, pork and beef added," the words "pork" and "beef" to appear in the order of their percentages, as above indicated.

SECTION 9. *Paragraph 1.* When a meat food product contains an added substance or substances, the label shall show the added substance or substances except as provided in the succeeding paragraphs of this section.

Paragraph 2. When cereal is added to sausage within the limit prescribed by paragraph 4 of section 6 of regulation 18, there shall appear on the label in a prominent manner, contiguous to the name of the product, the statement "cereal added." When water in excess of 3 per cent. and cereal are added to certain kinds of sausage as permitted by paragraph 5 of section 6 of regulation 18, the same shall be labeled "sausage, water, and cereal;" but when no cereal is added, the addition of water need not be stated.

Paragraph 3. When cereal is added to any meat food product other than sausage in quantities not exceeding 5 per cent., the statement "cereal added" shall appear on the label in a conspicuous manner contiguous to the name of the product, and if any such product contains cereal in quantities exceeding 5 per cent., then "cereal" shall appear as a part of the name of the product in uniform size and style of letters, for example, "potted meat and cereal": *Provided, however,* That, products such as meat loaves, pâtés, soups, tripe with onion sauce, Irish stew, stewed kidneys, hash, chile con carne, tamales, boiled dinners, chop suey, scrapple, and the like, may contain cereal and similar substances without the presence of such substances being indicated on the labels.

Paragraph 4. When edible parts of the head or viscera, or other similar edible parts, are added to any meat or product bearing a specific name, such as "meat," "beef," "pork," "veal," and the like, there shall appear on the label, in a prominent manner and contiguous to the name of the product, the statement "meat products added," provided such parts are not in excess of 20 per cent. If this percentage is exceeded, the words "and meat products" must appear as a part of the name of the product and in the same size and style of lettering. The percentage of such parts added to any meat or product shall be based on the weight of the meat ingredient of the product exclusive of added substances. When a potted, deviled, or similar article of food is prepared exclusively from the above mentioned parts, the product shall be labeled "potted meat products," "deviled meat products," and the like.

Paragraph 5 Lard may have added thereto not to exceed 10 per cent. of lard stearin without the presence of added stearin being shown on the label. When more than 10 per cent. of lard stearin is added to lard, there shall appear on the label, contiguous to and in the same size and style of lettering as the name of the product, the statement "lard stearin added."

Paragraph 6. When not over 20 per cent. of oleo stearin, beef fat, or mutton fat are added to lard, there shall appear on the label, contiguous to and in the same size and style of lettering as the name of the product, the statement "oleo stearin added," "beef fat added," or "mutton fat added," respectively, as the case may be.

Paragraph 7. Mixtures, of which the lard ingredient equals or exceeds in amount the other ingredients combined, may be labeled "lard compound," provided all the ingredients in the mixture are stated on the label in a prominent manner in the order of their percentages and preceded by the statement "composed of," or "made from," or an equivalent statement.

Paragraph 8. Labels for mixtures, other than oleomargarin, consisting of fat derived from carcasses of cattle, sheep, swine, or goats and any vegetable oil, shall bear the names of the ingredients in a prominent manner, in the order of their percentages, preceded by the statement "composed of," or "made from," or an equivalent statement. Tierces and barrels containing "compound" or "lard substitutes," or "lard compound," shall, immediately after filling, be legibly marked on one end, and on the side near the end, with the true name of the product. Tin pails, drums, tubs, and similar containers of such products shall bear the true name of the product also on the side at the time of filling.

Paragraph 9. Any meat or product containing any benzoate of soda shall be plainly labeled so as to show the presence and the percentage amount of such benzoate of soda.

Paragraph 10. When permitted coloring matter is used in the preparation of lard or other prepared animal fats under the provisions of paragraph 3 of section 6 of regulation 18, there shall appear on the label, prominently and contiguous to the name of the product, the statement "artificially colored."

SECTION 10. *Paragraph 1.* When the weight of any meat or product, prepared at an official establishment, or imported, prior to September 3, 1914, appears upon a label or container, it shall be the correct weight, and the words "net," "gross," "not less than," or a similar statement shall appear in direct connection therewith.

Paragraph 2. All meat and products in package form, prepared at official establishments, or imported, on or after September 3, 1914, shall have the quantity of the contents thereof plainly and conspicuously marked on the outside of the package in terms of weight, measure, or numerical count: *Provided,* That such reasonable variations and tolerances and also exemptions as to small packages shall be permitted as shall be established by rules and regulations made pursuant to the food and drugs act.

SECTION 11. *Paragraph 1.* No marks of federal inspection which have been previously used shall be again used for the identification of any meat or product except as provided in paragraph 2 of this section.

Paragraph 2. All stencils, marks, labels, or other devices, whether relating to any meat or product or otherwise, on previously used containers, shall be removed or obliterated before such containers are used for any meat or product, unless such stencils, marks, labels, or devices correctly indicate the article to be packed therein and such containers are refilled under the supervision of bureau employes.

SECTION 12. *Paragraph 1.* All labeling of meat and products required to be inspected by bureau employes shall be in compliance with these regulations.

Paragraph 2. No person shall apply or affix, or cause to be applied or affixed, any label to any article prepared or received in an official establishment or to any container thereof except in compliance with these regulations.

Paragraph 3. No person shall, in an official establishment, fill, or cause to be filled, in whole or in part, any container with any article required by these regulations to bear a label, except in compliance with these regulations.

Paragraph 4. No person shall remove or cause to be removed from an official establishment any meat or product bearing a label unless such label be in compliance with these regulations.

REGULATION 18. REINSPECTION AND PREPARATION OF MEAT AND PRODUCTS

SECTION 1. *Paragraph 1.* All meat and products, whether fresh or cured, even though previously inspected and passed, shall be reinspected by bureau employes as often as may be necessary, in order to ascertain whether the same are sound, healthful, wholesome, and fit for human food at the time the same leave official establishments. If upon such reinspection any article is found to have become unsound, unhealthful, unwholesome, or in any way unfit for human food, the original mark, stamp, or label thereon shall be removed or defaced and the article condemned.

Paragraph 2. Due care shall be taken to prevent meat and products from falling on the floor or becoming in any way contaminated. In event of their so falling or becoming contaminated, all, or such portion thereof as can not be cleaned and rendered wholesome and fit for food, shall be condemned.

SECTION 2. Upon all meat and products which are suspected on reinspection of being unsound, unhealthful, unwholesome, or in any way unfit for human food, or upon the containers thereof, there shall be placed by a bureau employe, at the time of reinspection, a "U. S. retained" tag. The employe who affixes the tag shall record the tag number and the kind and amount of the article retained. Such tag shall accompany such article to the retaining room or other special place for final inspection. When the final inspection is made, if the article is condemned, the original mark, stamp, or label thereon shall be removed or defaced and the inspector shall stamp or write across the face of the retained tag the phrase "U. S. inspected and condemned," and this tag shall accompany such article into the tank. The inspector shall make a complete record of the transaction and shall report his action to the inspector in charge. If, however, upon the final inspection the article is passed for food, the inspector shall remove the retained tag, record the transaction, and report his action to the inspector in charge.

SECTION 3. *Paragraph 1.* Except as provided in regulation 12, no meat or product shall be brought into an official establishment unless it has been previously inspected and passed by a bureau employe, nor unless it can be identified by marks, seals, brands, or labels as having been so inspected and passed, nor, except as provided in paragraph 2 of section 12 of regulation 27, if it has been processed elsewhere than in an official establishment. All meat and products brought into an official establishment in compliance with these regulations shall be identified and reinspected at the time of receipt, and be subject to further reinspection in such manner and at such times as may be deemed necessary. If upon such reinspection any article is found to be unsound, unhealthful, unwholesome, or otherwise unfit for human food, the original mark, stamp, or label shall be removed or defaced and the article condemned.

Paragraph 2. Except persons having unrevoked certificates of exemption and farmers slaughtering animals on the farm, who comply with the provisions of regulation 25 applicable to them, no person who slaughters cattle, sheep, swine, or goats, or processes any meat or product, in an establishment not having inspection in compliance with these regulations, shall transport or offer for transportation or cause or permit to be transported or offered for transportation any meat or product from such unofficial establishment in interstate or foreign commerce, or bring the same into an official establishment: *Provided, however,* That fresh meats and unmelted fresh fats which have been inspected and passed and which bear the inspection legend may be brought from any such unofficial establishment into official establishments in the same State, Territory, or District when such meats or fats are found upon reinspection to be sound, healthful, wholesome, and fit for human food.

Paragraph 3. Except as prohibited by paragraph 2 of this section, cod, kidney, and breast fat from inspected and passed beef carcasses may be brought from unofficial establishments, markets, or shops which handle no beef carcasses except those which have been inspected and passed into official establishments, provided such fats have been handled at all times in a sanitary manner and are found on reinspection, when received, to be sound, healthful, wholesome, and fit for human food.

SECTION 4. Every official establishment shall designate, with the approval of the inspector in charge, a dock or place at which returned meat and products shall be received, and such meat and products shall be received only at such docks or places and shall be there inspected by a bureau employe before entering the establishment.

SECTION 5. *Paragraph 1.* All processes used in curing, pickling, rendering, canning, or otherwise preparing any meat or product in official establishments shall be supervised by bureau employes. No fixtures or appliances, such as tables, trucks, trays, tanks, vats, machines, implements, cans, or containers of any kind, shall be used unless they are of such materials and construction as will not contaminate the meat and products and are clean and sanitary. All steps in the processes of manufacture shall be conducted carefully and with strict cleanliness in rooms or compartments separate from those used for inedible products.

Paragraph 2. All substances and ingredients used in the manufacture or preparation of any meat or product shall be clean, sound, healthful, wholesome, and otherwise fit for human food.

Paragraph 3. Pumps, pipes, conductors, and fittings used to conduct milk, cream, or mixtures of milk or cream in the manufacture of oleomargarin shall be of sanitary construction, with smooth inner and outer surfaces of noncorrosive material or coated with nickel, tin, or other approved material, readily demountable for cleaning, and shall be kept clean and sanitary.

SECTION 6. *Paragraph 1.* No meat or product shall contain any substance which impairs its wholesomeness, nor contain, except as permitted by paragraphs 2, 3, and 8 of this section, any dye, preservative, or added chemical.

Paragraph 2. There may be added to meat and products common salt, sugar, wood smoke, cider vinegar, wine vinegar, malt vinegar, sugar vinegar, glucose vinegar, spirit vinegar, pure spices, salt-peter, and nitrate of soda. Benzoate of soda may be added to meat and products only when declared on the label, as provided by paragraph 9 of section 9 of regulation 17.

Paragraph 3. Only harmless coloring matters may be used, and these only with the approval of and in such manner as may be designated by the department. Dyes may be used in or upon the products only in the manner and under the conditions following:

(*a*) The dyes may be mixed with prepared fats, such as lard and lard compounds.

(*b*) The dyes may be used for coloring sausage casings or other casings, by dipping or application, provided the character of the casing is such that the dye does not penetrate into the meat food product contained in the casing. If cloth casings are used, they shall be coated with uncolored paraffin before the application of the color.

(*c*) When artificial coloring matter is used, the product shall be marked or labeled as required by paragraph 2 of section 3 of regulation 16 and paragraph 10 of section 9 of regulation 17.

Paragraph 4. Sausage shall not contain cereal in excess of 2 per cent.

Paragraph 5. Water or ice shall not be added to sausage except for the purpose of facilitating grinding, chopping, and mixing, in which case the added water or ice shall not exceed 3 per cent., except that sausages of the class which are smoked or cooked, such as Frankfort style, Vienna style, and Bologna style, may contain added water in excess of 3 per cent., but not more than necessary to make the product palatable.

Paragraph 6. No "compound," lard substitute, lard, or lard compound shall contain added water.

Paragraph 7. The use of substances necessary for the proper preparation, clarification, or refining of meat and products may be permitted, subject to the approval of the Secretary of Agriculture, provided they do not impair the quality of the meat or product and are eliminated during the further process of manufacture; as, for example, the use of bicarbonate of soda and fullers' earth in the preparation of fats and the use of sal soda or lime in the cleansing of tripe.

Paragraph 8. When no substance is used in the preparation or packing thereof which, either in kind or in proportion, conflicts with the laws of the foreign country to which they are to be exported, and the foreign purchaser so directs in writing, meat food products for export to such foreign country may contain preservatives in accordance with such direction. Such products shall be prepared and packed in compartments of the establishment separate and apart from the compartments in which any meat or product is prepared or packed for domestic use or consumption, except as permitted by paragraph 9 of this section, and shall be kept separate.

Paragraph 9. The packing of articles which are prepared, as provided for in paragraph 8 of this section, with any preservative not permitted by paragraph 2 of this section may be done in the regular packing room, provided no other meat or product be allowed in the packing room during the time of such packing. After the packing is completed, the packing room shall be thoroughly cleansed of the preservative before the packing of other articles therein is resumed. A separate room or compartment constructed of tight partitions or walls shall be set apart for storing the preservatives, trays, and other appliances used in connection with the packing. This room or compartment shall be held under a lock furnished by the department, and the key shall not leave the custody of a bureau employe.

Paragraph 10. The packing of all articles under paragraphs 8 and 9 of this section shall be conducted under the personal supervision of a bureau employe.

Paragraph 11. No article prepared or packed for export under paragraph 8 or 9 of this section shall be sold or offered for sale for domestic use or consumption, unless and until destroyed for food purposes under the personal supervision of a bureau employe.

Paragraph 12. The contents of the container of any article prepared or packed for export under paragraph 8 or 9 of this section shall not be removed, in whole or in part, prior to exportation, except under the supervision of a bureau employe. If such contents be removed prior to exportation, then the article shall be either repacked, in accordance with the provisions of paragraph 8 or 9 and paragraph 10 of this section, or destroyed for food purposes under the personal supervision of a bureau employe.

Section 7. *Paragraph 1.* Any canned meat or product which requires sterilization to preserve it shall be sterilized on the same day that the cans are filled. Defective or leaky cans discovered after the process of sterilization has been completed shall not be repaired or repacked unless (*a*) the repairing or repacking be completed within 6 hours after the process of sterilization has been completed, or (*b*) if their defective or leaky condition be discovered during an afternoon run, they be held in coolers of a temperature not exceeding 34° F. until the following day, when they may be repaired or repacked. Sterilization will be deemed completed within the meaning of this paragraph when the cans have sufficiently cooled for inspection and handling. The contents of all defective or leaky cans not repaired or repacked in compliance with this paragraph shall be condemned.

Paragraph 2. Sausage prepared or packed in oil shall be heated to a temperature of at least 160° F. and this temperature maintained within the can for not less than 30 minutes. Cans should show good vacuum.

Paragraph 3. Meat and products cooked in official establishments shall be cooked only in such manner as may be approved by the chief of bureau.

Paragraph 4. Inasmuch as it can not certainly be determined, by any present known method of inspection, whether the muscle tissue of pork contains trichinæ, and inasmuch as live trichinæ are dangerous to health, no article, of a kind prepared customarily to be eaten without cooking, shall contain any muscle tissue of pork unless the pork has been subjected to a temperature sufficient to destroy all live trichinæ, or unless it be subjected to some other treatment, if any be discovered, hereafter approved by the chief of bureau, sufficient to destroy all live trichinæ.

Section 8. Unless labeled at once, canned meat and products shall be marked so as to maintain their identity until the final label is attached.

Section 9. *Paragraph 1.* The only animal casings that may be used as containers of any meat or product are those from cattle, sheep, swine, or goats.

Paragraph 2. Casings for meat and products shall be carefully inspected by bureau employes. Only those which have been carefully washed and thoroughly flushed with clean water, are suitable for containers, are clean, and are passed on such inspection, shall be used.

Paragraph 3. Portions of casings which show infestation with *Œsophagostomum* or other nodule-producing parasite, and weasands infested with the larvæ of *Hypoderma lineatum,* shall be rejected, except that when the infestation is slight and the nodules and larvæ are removed, the casing or weasand may be passed.

Paragraph 4. Intestines shall not be used as ingredients of meat food products.

Paragraph 5. The fermenting and sliming of hog and sheep casings shall be done only in compartments separate from those in which either edible or inedible products are handled.

Section 10. *Paragraph 1.* Heads for use in the preparation of meat food products shall be split and the bodies of the teeth, the turbinated and ethmoid bones, ear tubes, and horn butts removed and the heads then thoroughly cleaned.

Paragraph 2. Kidneys for use in the preparation of meat food products shall first be freely sectioned and then thoroughly soaked and washed. All detached kidneys, including beef kidneys detached with kidney fat, shall be inspected before being used in or shipped from the establishment.

Paragraph 3. Cattle paunches and hog stomachs for use in the preparation of meat food products shall be thoroughly cleaned on all surfaces and parts immediately after being emptied of their contents.

Paragraph 4. Tonsils shall be removed and shall not be used as ingredients of meat food products.

Section 11. No blood which comes in contact with the surface of the body of an animal or is otherwise contaminated shall be collected for food purposes. Only blood from animals the carcasses of which are inspected and passed may be used for meat food products. The defibrination of blood intended for food purposes shall not be performed with the hands.

Section 12. Lard which is to be labeled "pure lard" shall be prepared in equipment used exclusively for that product. Pipes used to convey leaf lard and pipes used to convey other kinds of lard shall be so arranged that the identity of each product shall be maintained until the product is properly labeled.

Section 13. Samples of meat and products, water, dyes, chemicals, preservatives, spices, or other articles in any official or exempted establishment shall be taken, without cost to the department, for examination, as often as may be deemed necessary by the bureau.

Section 14. No dye, chemical, preservative, or other substance, the use of which is prohibited by these regulations, shall be brought into or kept in an official establishment.

Section 15. No mixture which does not contain a considerable and definite proportion of inspected and passed meat or products shall bear the inspection legend or any abbreviation or representation thereof. If any mixture of which meat or product is an ingredient contains only inspected and passed meat or product, and such ingredient is not a considerable and definite proportion thereof, and any reference is made to inspection on the label or container thereof, such reference shall be in the following form: "The meat contained herein has been inspected and passed at an establishment where federal inspection is maintained." Any mixture which does not contain a definite or considerable proportion of any meat or product may be transported in interstate or foreign commerce without being inspected or labeled under these regulations, but subject to the provisions and requirements of the food and drugs act and the regulations made thereunder: *Provided,* That where such mixture is prepared in a part of an official establishment, the sanitation of that part of the establishment shall be supervised by bureau employes and the meat or product used as an ingredient therein shall be inspected before it enters the mixture.

REGULATION 19. MARKET INSPECTION

SECTION 1. *Paragraph 1.* Market inspection may be established to provide for the interstate transportation or export, from public markets and other places, of portions of inspected and passed meat and products which, when cut or otherwise removed from a marked carcass, part, or container, do not show the inspection legend. Each city in which market inspection is established shall be assigned an official number by the chief of bureau, and all articles transported under such inspection shall bear the inspection legend and the official number of the city.

Paragraph 2. Persons granted inspection under paragraph 1 of this section shall conform to the requirements of the department governing sanitation, the use of dyes, chemicals, and preservatives, and such other matters as may be specified from time to time by the chief of bureau as applicable thereto.

SECTION 2. Unmarked portions cut from a marked carcass or part or removed from a marked container, under market inspection, for interstate transportation or for export, shall be inspected by a bureau employe at the time they are so cut or removed, and, if found to be sound, healthful, wholesome, and fit for human food, shall be marked with the inspection legend. Whenever practicable, the brand shall be applied to the meat itself. When this can not be done, the container thereof shall be marked, for interstate transportation, as required by regulation 16, or, for export, as required by regulation 24.

REGULATION 20. REPORTS

SECTION 1. Reports of the work of inspection carried on in every official establishment shall be forwarded to the department by the inspector in charge, on such blank forms and in such manner as may be specified by the chief of bureau.

SECTION 2. Bureau employes shall make daily reports of the amounts of articles handled or prepared in the subdivisions of the establishments to which they are assigned, and of such other things as the chief of bureau may require.

SECTION 3. Each official establishment shall furnish to bureau employes accurate information as to all matters needed by them for making their reports pursuant to section 2 of this regulation.

SECTION 4. Reports on sanitation shall be made by the bureau employes assigned to the various subdivisions of official establishments to the inspector in charge, and by the inspector in charge to the chief of bureau.

REGULATION 21. APPEALS

SECTION 1. When the action of an inspector in condemning any meat or product is questioned, appeal may be made to the inspector in charge, and from his decision appeal may be made to the chief of bureau, or to the Secretary of Agriculture, whose decision shall be final.

REGULATION 22. COOPERATION WITH LOCAL AUTHORITIES

SECTION 1. Inspectors in charge shall cooperate, whenever practicable to do so in compliance with these regulations, with State, municipal, and other local officials in matters pertaining to meat inspection.

SECTION 2. Inspectors in charge shall confer with such officials at their stations and inform them of the federal meat inspection service, what the bureau is accomplishing in that particular locality, and in turn ascertain what is being done by the local officials. Such conferences shall be had from time to time as may be practicable and mutually agreeable, with a view to federal and local officials each being helpful to the other in handling problems where assistance is required for the good of the service, and particularly for the purpose of preventing the use of unfit meat and products for food.

SECTION 3. If it be proposed to adopt a definite cooperative arrangement, the details thereof shall be submitted to and approved by the chief of bureau before it is put into effect.

REGULATION 23. BRIBERY, COUNTERFEITING, ETC.

Section 1. It is a felony, punishable by fine and imprisonment, for any person, firm, or corporation to give, pay, or offer, directly or indirectly, to any bureau employe authorized to perform any duty prescribed by the meat inspection act or these regulations, any money or other thing of value with intent to influence such employe in the discharge of his duty. It is also a felony, punishable by fine and imprisonment, for any bureau employe engaged in the performance of any duty prescribed by the meat inspection act or these regulations to receive or accept from any person, firm, or corporation engaged in interstate or foreign commerce any gift, money, or other thing of value given with any purpose or intent whatsoever.

Section 2. It is a misdemeanor, punishable by fine and imprisonment, for any person, firm, or corporation, or officer, agent, or employe thereof, to forge, counterfeit, simulate, or falsely represent, or without proper authority to use, fail to use, or detach, or knowingly or wrongfully to alter, deface, or destroy, or to fail to deface or destroy, any of the marks, stamps, tags, labels, or other identification devices provided for in the meat inspection act or in and as directed by these regulations, on any carcass, part of carcass, or the food product or containers thereof, subject to the provisions of the meat inspection act, or any certificate in relation thereto authorized or required in the meat inspection act or as directed in these regulations.

Section 3. Any meat or product which bears, or the container of which bears, the inspection legend or any other mark prescribed by the meat inspection act, the imported meat act, or these regulations, shall be subject to inspection at any time or place.

Section 4. Bureau employes shall report, in such form and manner as the chief of bureau shall prescribe, any meat or product which bears, or the container of which bears, the inspection legend or any other mark prescribed by the meat inspection act, the imported meat act, or these regulations, discovered by them outside of official establishments and which is unsound, unhealthful, unwholesome, or in any way unfit for human food, so that criminal proceedings, proceedings for the seizure of any such article under the food and drugs act, or other proceedings may be instituted, as the facts may warrant.

REGULATION 24. EXPORT STAMPS AND CERTIFICATES[1]

SECTION 1. *Paragraph 1.* A numbered meat inspection stamp shall be affixed to each outside container (except cloth wrappings) of any inspected and passed meat or product for export.

Paragraph 2. Such stamps shall be securely affixed either (*a*) in a grooved space made by removing a portion of the wood of sufficient size to admit the stamp, or (*b*) on either end of the package, provided that the sides thereof are made to project at least ⅛ inch to afford the necessary protection from abrasion.

Paragraph 3. The cloth wrapping used as an outside container of any inspected and passed meat or product for export shall bear the inspection legend and the establishment number applied by an ink brand.

SECTION 2. *Paragraph 1.* Upon application of the exporter, the inspector in charge is authorized to issue certificates for shipments of inspected and passed meat and products to any foreign country. Certificates should be issued at the time the articles leave the establishment; if not issued at that time, they may be issued later only after identification and reinspection of the articles.

Paragraph 2. Export certificates shall be issued in serial numbers and in triplicate form. Each certificate shall show the names of the exporter and the consignee, the destination, the numbers of the stamps, if any, attached to the articles to be exported, the shipping marks, the kind of product, and the weight.

Paragraph 3. Only one certificate shall be issued for each consignment, unless otherwise directed by the chief of bureau.

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[1] Attention is directed to the requirements of regulation 25 governing transportation, and to the requirement of paragraph 11 of section 6 of regulation 18 that articles prepared under said section 6 for export be destroyed for food purposes before being sold or offered for sale for domestic use or consumption.

Paragraph 4. The original certificate shall be delivered to the shipper and shall be used only for the purpose of effecting the transportation and delivery of the consignment.

Paragraph 5. The duplicate of the certificate shall be delivered to the shipper. It shall be used only as the certificate required by the meat inspection act to be delivered to the chief officer of the vessel on which the export shipment is made and without which no clearance shall be given to any vessel having aboard any meat or product. Such chief officer shall file such duplicate with the customs officer at the time of filing the master's manifest or the supplemental manifest.

Paragraph 6. The triplicate of the certificate shall be retained by the inspector in charge issuing the same and forwarded to the department for filing.

Paragraph 7. Under no circumstances shall the original or the triplicate of such certificate be used for the purpose for which it is prescribed by paragraph 5 of this section that the duplicate shall be used.

Section 3. *Paragraph 1.* No person operating any steam or sailing vessel shall receive for transportation or transport from the United States to Great Britain or Ireland, or any of the countries of continental Europe or to Argentina, Peru, Mexico, or the French Antilles, any meat or product, except ship stores, unless and until a certificate of inspection or exemption from inspection covering the same has been issued and delivered as provided in this regulation. The requirement of export certificates is waived for meat and products exported to countries other than those named in this paragraph, and to all countries in cases of meat and products covered by exemption export certificates issued pursuant to paragraph 2 of this section.

Paragraph 2. Upon application to the chief of bureau, exemption export certificates, showing exemption from inspection, shall be issued by the department, for each consignment for export, covering articles permitted by sections 7 and 8 of regulation 25 to be transported in interstate or foreign commerce without inspection.

Section 4. Numbered inedible-product stamps and certificates of a distinctive color may be issued, upon request of the shipper, for export shipments of casings, bladders, hoofs, horns, and similar inedible animal products.

Section 5. No tallow, stearin, oleo oil, or the rendered fat derived from cattle, sheep, swine, or goats that has not been inspected, passed, and marked in compliance with these regulations shall be exported, unless the shipper files with the collector of customs at the port from which the export shipment is made an affidavit by the exporter that such article is inedible.

Section 6. *Paragraph 1.* Numbered stamps and certificates of a distinctive color, to be known as preservative stamps and certificates, shall be issued to identify all articles prepared or packed with preservatives for export. The stamps shall be securely affixed to containers of the articles before they leave the establishment, in the manner prescribed by paragraph 2 of section 1 of this regulation. Unless, upon special application to him, the chief of bureau shall otherwise direct, the certificates shall be issued before the articles leave the establishment and shall be issued and used in the same way and shall serve the same purposes, respectively, as the certificates issued pursuant to section 2 of this regulation.

Paragraph 2. Prior to export no preservative stamp required by this section shall be deteached from the container except under the personal supervision of a bureau employe. If the preservative stamp be detached, then the article in the container shall be either repacked, in accordance with the provisions of paragraph 8 or 9 and paragraph 10 of section 6 of regulation 18, or destroyed for food purposes under the supervision of a bureau employe.

REGULATION 25. TRANSPORTATION[1]

SECTION 1. No carrier or other person shall transport or receive for transportation from one State or Territory or the District of Columbia to another State or Territory or the District of Columbia, or to any place under the jurisdiction of the United States, or to a foreign country, any article derived wholly or in part from cattle, sheep, swine, or goats unless and until a certificate is made and furnished to him in one of the forms prescribed therefor in this regulation: *Provided, however,* That any such article offered for importation into the United States may be transported and received for transportation from one State or Territory or the District of Columbia into another State or Territory or the District of Columbia, without such a certificate, if such meat or product is conveyed, prior to inspection, in cars, wagons, vehicles, or packages, sealed with special import meat seals of the Department of Agriculture or with customs or consular seals as provided in paragraph 8 of section 7 of regulation 27.

SECTION 2. *Paragraph 1.* For the purposes of these regulations the United States parcel post shall be deemed a carrier, and the provisions of these regulations relating to transportation by carriers shall apply, so far as they may be applicable, to transportation by parcel post.

Paragraph 2. For the purposes of these regulations every ferry and ferry line shall be deemed a carrier and the provisions of these regulations relating to transportation by carriers shall apply to transportation by ferry or ferry line of any meat or product loaded on a truck, wagon, cart, or other vehicle, or otherwise prepared for transportation.

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[1] The transportation of any meat or product from one point in a State or Territory to another point in the same State or Territory, when in the course of shipment the article is taken through another State or Territory, is interstate commerce.

In connection with the wording of the inspection legend as required in certificates under this regulation, attention is further directed to sections 2 and 3 of regulation 1.

Attention is directed to the facts that the meat inspection act prohibits the transportation of any meat or product which does not comply with the law and these regulations, and makes a violation either of the act or of these regulations a criminal offense punishable by a fine of $10,000 and imprisonment for two years.

Attention is also directed to the additional requirements of regulation 24 governing export stamps and certificates, and to section 10 of regulation 16.

Section 3. When any shipment of any meat or product is offered to any carrier for transportation within the United States as a part of a foreign movement, the same certificate shall be required as if the shipment were destined to a point within the United States.

Section 4. *Paragraph 1.* Jobbers, wholesalers, and others who do no slaughtering or processing and who receive meat and products which have not been processed other than under inspection in compliance with these regulations may break bulk, repack, and ship the same in interstate commerce under section 5 of this regulation provided that each article so shipped bears the inspection legend and is sound, healthful, wholesome, and fit for human food at the time of such shipment.

Paragraph 2. Jobbers, wholesalers, and others who do no slaughtering or processing and who receive meat and products which have not been processed other than under inspection in compliance with these regulations may ship such articles in interstate commerce under section 5 of this regulation in the original containers in which the same were received by them, provided that such containers bear the inspection legend and the articles are sound, healthful, wholesome, and fit for human food at the time of such shipment.

Paragraph 3. The provisions of paragraphs 1 and 2 of this section apply to branch houses of official establishments when, and only when, no slaughtering or processing of any character is done in such branch houses.

Paragraph 4. Nothing contained in this section shall be construed as limiting the authority of bureau employes under other regulations to make inspections and reinspections of articles bearing marks of inspection.

Section 5. When any meat or product which has been inspected and passed and bears the inspection legend is offered to any carrier for transportation from one State or Territory or the District of Columbia to or through another State or Territory or the District of Columbia, or to any place under the jurisdiction of the United States, or to a foreign country, the carrier shall require, and the shipper shall make and deliver to the carrier, a certificate in the following form, except as provided in section 6 of this regulation:

Date........................, 191 .

Name of carrier..
Shipper ....
Point of shipment..
Consignee ....
Destination ....

I hereby certify that the following described meat or meat food products, which are offered for shipment in interstate or foreign commerce, have been inspected and passed according to the act of Congress of June 30, 1906, are so marked, and at this date are sound, healthful, wholesome, and fit for human food.

Kind of product.	Amount and weight.
....	....
....	....
....	....

....
(Signature of shipper.)

....
(Address of shipper.)

The signature of the shipper or of his agent shall be written in full. This certificate may be stamped upon or incorporated in any form which is ordinarily used in the transportation of meat and products. Certificates of this form or copies thereof need not be forwarded to the department at Washington.

SECTION 6. *Paragraph 1.* Any meat or product which has been inspected and passed may be transported from one official establishment to any other official establishment without each article being marked with the inspection legend, provided that the same is placed in a railroad car which is sealed[1] by a bureau employe with the official seal of the department bearing the inspection legend. Unless 25 per cent. or more of the contents of each car consist of meat and products not marked with the inspection legend, transportation will not be permitted under this paragraph.

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[1] Attention is directed to the law which provides a penalty of fine and imprisonment for breaking a seal on such cars without authority.

Paragraph 2. When articles are offered for transportation under paragraph 1 of this section the carrier shall require, and the shipper shall make and deliver to the carrier, a certificate in duplicate in the following form.[1]

Date......................., 191 .

Name of carrier..
Establishment number of consignor..................................
Point of shipment...
Establishment number of consignee ....
Destination ....
Car number and initials ....

I hereby certify that the following described meat or meat food products have been inspected and passed according to the act of Congress of June 30, 1906. They are not marked "U. S. inspected and passed," but have been placed in the above car under the supervision of an employe of the Bureau of Animal Industry and the car has been sealed by him with Government seals Nos. .... and ....

Kind of product.	Amount and weight.
....	....
....	....
....	....

....
(Signature of shipper.)

....
(Address of shipper.)

The signature of the shipper or of his agent shall be written in full. This certificate shall be separate and apart from any waybill, bill of lading, or other form ordinarily used in the transportation of meat. The duplicate certificate shall be forwarded immediately by the initial carrier to the Chief of the Bureau of Animal Industry, Washington, D. C.

For the purpose of the certificate under this paragraph all articles in cars permitted by paragraph 1 of this section to be sealed shall be deemed to be "not marked."

Paragraph 3. When shipments are made under paragraph 1 of this section the inspector in charge at the point of origin shall immediately notify the chief of bureau and the inspector in charge at the point of destination.

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[1] For convenience in filing it is requested that these certificates be made on paper 5½ by 8 inches in size.

Paragraph 4. Inspected and passed articles may be transported from one official establishment to any other official establishment, without each article being marked with the inspection legend, in a wagon securely sealed by a bureau employe with the official seal of the department bearing the inspection legend. Only wagons properly equipped for the purpose may be sealed under this paragraph.

Paragraph 5. Except as provided in paragraph 2 of section 14 of this regulation, seals affixed under this section shall be broken by bureau employes, and no person other than a bureau employe shall detach, break, change, or tamper with any such seal in any way whatever.

SECTION 7. When any meat or product which has not been inspected and passed under these regulations is offered for transportation from one State or Territory or the District of Columbia to or through another State or Territory or the District of Columbia, or to any place under the jurisdiction of the United States, or to a foreign country, by any retail butcher or retail dealer supplying a customer, who holds a certificate of exemption issued in compliance with these regulations, the carrier shall require, and such retail butcher or retail dealer shall make and deliver to the carrier, a certificate in duplicate in the following form:[1]

Date......................., 191 .

Name of carrier ....
Shipper ....
Point of shipment...
Consignee ....
Destination ....
Number of exemption certificate...................................

I hereby certify that I am a retail butcher or a retail dealer in meat or meat food products; that the following described meat or meat food products are offered for shipment in interstate or foreign commerce to a customer, as exempted from inspection according to the act of Congress of June 30, 1906, under certificate issued to me by the United States Department of Agriculture, and that at this date they are sound, healthful, wholesome, and fit for human food, and contain no preservative or coloring matter or other substance prohibited by the regulations of the Secretary of Agriculture governing meat inspection.

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[1] For convenience in filing it is requested that these certificates be made on paper 5½ by 8 inches in size.

Kind of product.	Amount and weight.
....	....
....	....
....	....

....
(Signature of shipper.)

....
(Address of shipper.)

The signature of the shipper or of his agent shall be written in full, and each certificate shall show the exemption number of the shipper. This certificate shall be separate and apart from any waybill, bill of lading, or other form ordinarily used in the transportation of meat. The duplicate certificate shall be forwarded immediately by the initial carrier to the Chief of the Bureau of Animal Industry, Washington, D. C.

SECTION 8. When cattle, sheep, swine, or goats have been slaughtered by a farmer on the farm, and any meat or product derived therefrom is offered to a carrier for transportation from one State or Territory or the District of Columbia to or through another State or Territory or the District of Columbia, or to any place under the jurisdiction of the United States, or to a foreign country, the carrier may so transport such meat or product which is identified as derived from any of such animals slaughtered by a farmer on the farm. The carrier shall require, and the shipper shall make and deliver to the carrier, a certificate in duplicate in the following form: [1]

Date......................., 191 .

Name of carrier..
Shipper ....
Point of shipment..
Consignee ....
Destination ....

I hereby certify that the following described uninspected meat or meat food products are from animals slaughtered by a farmer on the farm, and are offered for transportation in interstate or foreign commerce as exempted from inspection according to the act of Congress of June 30, 1906, and that at this date they are sound, healthful, wholesome, and fit for human food, and contain no preservative or coloring matter or other substance prohibited by the regulations of the Secretary of Agriculture governing meat inspection.

---

[1] For convenience in filing it is requested that these certificates be made on paper 5½ by 8 inches in size.

Kind of product.	Amount and weight.
....	....
....	....
....	....

....
(Signature of shipper.)

....
(Address of shipper.)

The signature of the shipper or of his agent shall be written in full. This certificate shall be separate and apart from any waybill, bill of lading, or other form ordinarily used in the transportation of meat. The duplicate certificate shall be forwarded immediately by the initial carrier to the Chief of the Bureau of Animal Industry, Washington, D. C.

SECTION 9. All waybills, transfer bills, running slips, or conductor's cards accompanying an interstate or foreign shipment of any meat or product shall have embodied therein, stamped thereon, or attached thereto a signed statement which shall be evidence to connecting carriers that the proper shipper's certificate, as required by sections 5, 6, 7, and 8 of this regulation, is on file with the initial carrier; and no connecting carrier shall receive for transportation or transport any interstate or foreign shipment of any meat or product unless the waybill, transfer bill, running slip, or conductor's card accompanying the same includes the aforesaid signed statement in one of the following forms:

When shipment is made under section 5 or 6:

(Name of transportation company.)

United States inspected and passed, as evidenced by shipper's certificate on file with initial carrier.

(Signed)........................., *Agent.*

When shipment is made under section 7 or 8:

(Name of transportation company.)

Exempted from inspection, as evidenced by shipper's certificate on file with initial carrier.

(Signed)...................., *Agent.*

Signatures of agents to statements required under this section shall be written in full.

SECTION 10. When it is claimed that any meat or product, which has theretofore been inspected and passed and marked with the inspection legend, has become unsound, unhealthful, unwholesome, or in any way unfit for human food after it has been transported for sale away from an official establishment, then, in order to ascertain whether it is unsound, unhealthful, unwholesome, or in any way unfit for human food, the same may be transported from one State or Territory or the District of Columbia to any official establishment in the same or another State or Territory or the District of Columbia if a written permit in duplicate for such shipment is first obtained from the inspector in charge of the establishment to which the shipment is destined. In case of every such shipment both the original and the duplicate of the permit shall be surrendered to the carrier, and the carrier shall require, and the shipper shall make and deliver to the carrier, a certificate in duplicate in the following form:[1]

I hereby certify that the following described meat or meat food products have been inspected and passed according to the act of Congress of June 30, 1906, and are so marked. It is alleged that the said meat or meat food products are unsound, unhealthful, unwholesome, and unfit for human food.

Kind of product.	Amount and weight.

(Signature of shipper.)

(Business or occupation of shipper.)

(Address of shipper.)

The signature of the shipper or of his agent shall be written in full, and the certificate shall in every case contain a description and the weight of the meat or product. This certificate shall be separate and apart from any waybill, bill of lading, or other form ordinarily used in the transportation of meat. One of these certificates and the duplicate copy of the inspector's permit shall be retained by the carrier; the other copy of the certificate and the original inspector's permit shall be forwarded immediately to the Chief of the Bureau of Animal Industry, Washington, D. C.

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[1] For convenience in filing it is requested that these certificates be made on paper 5½ by 8 inches in size.

As evidence to connecting carriers that the proper shipper's certificate as required by this paragraph is on file with the initial carrier, the waybills, transfer bills, running slips, or conductor's cards accompanying such shipments shall have embodied therein, stamped thereon, or attached thereto a signed statement in the following form:

(Name of transportation company.)

Meat or meat food product alleged to be unsound, unwholesome, or otherwise unfit for food, as evidenced by shipper's certificate on file with initial carrier.

(Signed) ...., *Agent.*

The signature of the agent shall be written in full.

Upon the arrival of the shipment at the establishment, a careful inspection shall be made of the meat or product by a bureau inspector, and if it is found that the article is sound, healthful, wholesome, and fit for human food, the same may be received into the establishment; but if the article is found to be unsound, unhealthful, unwholesome, or in any way unfit for human food, the same shall at once be stamped "U. S. inspected and condemned" and disposed of in accordance with these regulations.

No meat or product which is unsound, unhealthful, unwholesome, or in any way unfit for human food shall be transported from an official establishment under this section, but it shall be disposed of at the establishment in accordance with these regulations.

SECTION 11. Any uninspected meat or product, or any inspected and passed meat or product, which is known to have become unsound, unhealthful, unwholesome, or in any way unfit for human food, may be transported from one State or Territory or the District of Columbia to or through another State or Territory or the District of Columbia, or to any place under the jurisdiction of the United States, or to a foreign country, for industrial use, provided it is first denatured or otherwise destroyed for food purposes. The shipper shall not offer nor the carrier accept for interstate or foreign transportation any such article until it has been denatured or otherwise destroyed for food purposes. The carrier shall require, and the shipper shall make and deliver to the carrier, a certificate in duplicate in the following form:[1]

Date........................191

Name of carrier ....
Consignor ....
Point of shipment..
Consignor ....
Destination ....

I hereby certify that the following described inedible meat or meat food products have been denatured or otherwise rendered unavailable for food purposes.

Kind of product.	Amount and weight.
....	....
....	....
....	....

....
(Signature of shipper.)
....
(Business or occupation of shipper.)
....
(Address of shipper.)

The signature of the shipper or of his agent shall be written in full. This certificate shall be separate and apart from any waybill, bill of lading, or other form ordinarily used in the transportation of meat. The duplicate certificate shall be forwarded immediately by the initial carrier to the Chief of the Bureau of Animal Industry, Washington, D. C.

As evidence to connecting carriers that the proper shipper's certificate is on file with the initial carrier, the waybills, transfer bills, running slips, or conductor's cards, accompanying such shipments shall have embodied therein, stamped thereon, or attached thereto a signed statement in the following form:

(Name of transportation company.)

Unsound, unwholesome, or other wise unfit for food, and denatured or otherwise rendered unavailable for food purposes, as evidenced by shipper's certificate on file with initial carrier.

(Signed)........................., *Agent.*

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[1] For convenience in filing it is requested that these certificates be made on paper 5½ by 8 inches in size.

The signature of the agent shall be written in full.

SECTION 12. When inedible grease or tallow or other inedible article derived wholly or in part from cattle, sheep, swine, or goats, suitable only for industrial use, is of such a nature or for such an industrial use that it is impracticable to denature the same, such product may be transported from one State or Territory or the District of Columbia to or through another State or Territory or the District of Columbia, or to any place under the jurisdiction of the United States, or to a foreign country, without denaturing, if both ends of the containers are painted white and conspicuously stenciled or burned with the true name of the product and the word "inedible" in letters not less than 2 inches high, and the other provisions of this section are complied with. The carrier shall require, and the shipper shall make and deliver to the carrier, a certificate in duplicate in the following form:[1]

Date........................, 191 .

INEDIBLE FAT

Name of carrier ....

Consignor ....

Point of shipment ....

Consignee ....

Destination ....

I hereby certify that the following described fat is not capable of being used as food by man, is suitable only for industrial purposes, is not for food purposes, and is of such a character or for such a use that denaturing is impracticable. I further certify that there is now on file with the Secretary of Agriculture a declaration by the establishment in which said fat was prepared, or from which it is offered for shipment, in compliance with section 6 of regulation 4 of the regulations of the Secretary of Agriculture governing meat inspection.

Kind of product.	Amount and weight.
....	....
....	....
....	....

....

(Signature of shipper.)

....

(Business or occupation of shipper.)

....

(Address of shipper.)

---

[1] For convenience in filing it is requested that these certificates be made on paper 5½ by 8 inches in size.

The signature of the shipper or of his agent shall be written in full. This certificate shall be separate and apart from any waybill, bill of lading, or other form ordinarily used in the transportation of meat. The duplicate certificate shall be forwarded immediately by the initial carrier to the Chief of the Bureau of Animal Industry, Washington, D. C.

As evidence to connecting carriers that the proper shipper's certificate is on file with the initial carrier, the waybills, transfer bills, running slips, or conductor's cards accompanying such shipments shall have embodied therein, stamped thereon, or attached thereto a signed statement in the following form:

(Name of transportation company.)

Inedible and suitable only for industrial purposes, as evidenced by shipper's certificate on file with initial carrier.

(Signed) .... *Agent.*

The signature of the agent shall be written in full.

SECTION 13. All original certificates delivered to a carrier in accordance with this regulation shall be filed separate and apart from all its other papers and records and retained by it for 1 year, so that they may be readily checked in such manner as the Secretary of Agriculture may from time to time prescribe.

SECTION 14. *Paragraph 1.* Shipments of inspected and passed meat and products that bear the inspection legend may be diverted from the original destination without a reinspection of the articles, or in case of wreck or other extraordinary emergency the carrier may divert such shipments from the original destination without a reinspection of the articles, provided the waybills, transfer bills, running slips, or conductor's cards accompanying the shipments are marked, stamped, or have attached thereto signed statements in accordance with section 9 of this regulation.

Paragraph 2. In case of wreck or other extraordinary emergency, the department seals on a car containing any inspected and passed meat or product may be broken by the carrier, and, if necessary, the articles may be reloaded into another car, or the shipment may be diverted from the original destination, without another shipper's certificate; but in all such cases the carrier shall immediately report the facts by telegraph to the Chief of the Bureau of Animal Industry, Washington, D. C. Such report shall include the following information:

(*a*) Nature of the emergency.

(*b*) Place where seals were broken.

(*c*) Original points of shipment and destination.

(*d*) Number and initials of the original car.

(*e*) Number and initials of the car into which the articles are reloaded.

(*f*) New destination of the shipment.

(*g*) Kind and amount of articles.

SECTION 15. The provisions of this regulation do not apply to specimens of meat and products sent to or by the Department of Agriculture or branches thereof in Washington, D. C., or elsewhere, for laboratory examination, exhibition purposes, or other official use.

REGULATION 26. FOOD AND DRUGS ACT

SECTION 1. Inspected and passed meat and products, like uninspected meat and products, shall comply with the provisions of the food and drugs act in every respect. Failure to comply renders all such articles sold or offered for sale in the District of Columbia or any Territory or other place under the jurisdiction of the United States, or shipped or delivered for shipment from one State or Territory or the District of Columbia to another State or Territory or the District of Columbia, or to any foreign country, liable to seizure for condemnation, and renders manufacturers, vendors, and shippers in appropriate cases amenable to prosecution under the food and drugs act.

REGULATION 27. IMPORTED MEAT AND PRODUCTS[1]

SECTION 1. *Paragraph 1.* This regulation shall apply only to meat and products derived from cattle, sheep, swine, and goats.[2]

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[1] Imported meat and products after admission into the United States are deemed and treated as domestic articles (38 Stat. 159). Attention is invited particularly to regulations 1, 16, 17 (sec. 7-12 incl.); 18 [sec. 3, 6, 9 (par. 1), 15]; 25, 26.

[2] The importation of edible products derived wholly or in part from animals other than cattle, sheep, swine, and goats is governed by the food and drugs act as amended and the rules and regulations made pursuant thereto.

Paragraph 2. The term United States, as used in this regulation, includes Alaska, and the islands of Hawaii, and Porto Rico.

Section 2. Whenever it shall be determined by the Secretary of Agriculture, after due investigation, that the system of meat inspection maintained by any foreign country is not the substantial equivalent of, or is not as efficient as, the system established and maintained by the United States, or that the inspection made by any foreign country is not the substantial equivalent of, or is not as efficient as, the inspection made by the United States, or that reliance can not be placed upon certificates required under this regulation from authorities of such foreign country, due notice will be given of that fact by proclamation or otherwise, and thereafter no meat or product, as to which the inspection or certification is determined to be insufficient, shall be admitted into the United States from such foreign country.

Section 3. *Paragraph 1.* No meat or product of a kind forbidden entry into, or forbidden to be sold or restricted in sale in, the country in which the animal from which it was derived was slaughtered, or in which the article was prepared or processed, shall be admitted into the United States.

Paragraph 2. No meat or product which contains or has been treated with any preservative, coloring matter, or other substance, except as permitted by regulation 18, shall be admitted into the United States. No article of a kind mentioned in paragraph 4 of section 7 of regulation 18, unless treated in compliance therewith, shall be admitted into the United States.

Paragraph 3. No meat or product which bears, or the container of which bears, any statement, design, or device prohibited by sections 7 to 11, inclusive, of regulation 17, or which is in any respect misbranded or adulterated within the meaning of the food and drugs act, as amended, shall be admitted into the United States.

Paragraph 4. No meat trimmings in pieces too small to permit of adequate inspection upon arrival shall be admitted into the United States.

Paragraph 5. No inedible grease, inedible tallow, or other inedible rendered fat shall be admitted into the United States unless both ends of each container, such as barrels, tierces, or tank cars, are painted white and conspicuously stenciled or burned with the name of the product and the word "inedible" in letters not less than 2 inches high, or, in the case of tank cars, not less than 4 inches high.

Paragraph 6. Grease, tallow, and other rendered fat which is capable of being used for food by man, for inspection purposes will be dealt with as edible unless otherwise declared on the invoice. Shipments of grease, tallow, and other rendered fat offered for importation for industrial purposes should be accompanied by a declaration stating that fact.

SECTION 4. No meat or product offered for importation from any foreign country shall be admitted into the United States, except upon compliance with all the requirements of this regulation applicable to it.

SECTION 5. *Paragraph 1.* Except as provided in section 11 of this regulation, each consignment containing any meat or product, consigned to the United States from the foreign country of the slaughter of the animals from which it was derived, and transported from such foreign country without unloading in any other foreign country for any purpose except transfer from one carrier to another in the course of continuous transportation to the United States, shall be accompanied by a foreign meat inspection certificate in the following form:

OFFICIAL MEAT INSPECTION CERTIFICATE OF COUNTRY OF SLAUGHTER

(For continuous shipment of meat and meat food products to United States.)

Place .... Date ....
(City.) (Country.)

I hereby certify that the meat and meat food products herein described were derived from cattle, sheep, swine, or goats which received ante-mortem and post-mortem veterinary inspection at the time of slaughter, and that such meat and meat food products are sound, healthful, wholesome, and otherwise fit for human food, and have not been treated with, and do not contain, any preservative, coloring matter, or other substance not permitted by the regulations of the United States Secretary of Agriculture governing meat inspection, filed with me, and that said meat and meat food products have been handled only in a sanitary manner in this country.

Kind of product.	Number of pieces or packages.	Weight.
....	....	....
....	....	....
....	....	....
....	....	....

Identification marks on meat and packages ....
Consignor .... Address ....
Consignee .... Destination ....
Shipping marks ....
(Signature) ....
(Name of official of national foreign government authorized to issue inspection certificates for meat and meat food products exported to the United States.)
(Official title) ....

NOTE.—A certificate in the above form is required to accompany each consignment transported to the United States from the country of the slaughter of the animals from which the meat and meat food products are derived, without unloading in any other country except to transfer the same from one carrier to another in the course of continuous transportation, and to be delivered by the consignee, or his agent, to the inspector of the Department of Agriculture at the point of inspection in the United States.

The following information is required to be supplied on the certificate by each carrier loading the consignment:

Loaded ....at..............................on
(Date.) (Place.)
....
(Name of vessel or car numbers and initials.)
....; and, if unloaded at any
(Signature of officer or agent of carrier making indorsement.)
place prior to arrival in the United States, unloaded..................
(Date.)
at................................, by the........................
(Place.) (Name of carrier.)
....; and reloaded
(Signature of officer or agent of carrier making indorsement.)
..................................at ....on
(Date.) (Place.)
..................................by the..........................
(Name of vessel or car numbers and initials) (Name of carrier.)
....
(Signature of officer or agent of carrier making indorsement.)

Paragraph 2. Except as provided in section 11 of this regulation, each consignment containing any meat or product consigned to a country other than the United States at the time it leaves the foreign country of the slaughter of the animals from which it was derived, which is reconsigned and transported to the United States from such foreign country without unloading in any other foreign country for any purpose except transfer from one carrier to another in the course of continuous transportation to the United States, shall be accompanied by a certificate in the form prescribed by paragraph 1 of this section, to which there shall be attached a declaration, made before a United States consular officer by the consignor or his agent in the country from which consigned to the United States, as follows:

I (we), the undersigned, do solemnly and truly declare that the meat and meat food products described in the annexed certificate, and designated below, arrived in this country................at.................
(Date.) (Place.)
on ....
(Name of vessel or car numbers and initials.)

and that the same have not been unloaded in this country for any purpose except transfer from the carrier on which the same arrived in this country to another in the course of transportation and reloading for transportation to the United States..................................
..................................at ....
(Date.) (Place.)
on ....
(Name of vessel or car numbers and initials.)

Kind of product.	Number of pieces or packages.	Weight
....	....	....
....	....	....
....	....	....
....	....	....

Identification marks on meats and packages..........................
Consignor in country of slaughter..................................
Consignee in country of reloading ....
Consignee in United States ....
Destination ....
Shipping marks...
Dated at..this
..........................day of..................191 .

(Signed)..................................
(Name of shipper or his agent.)
....
(Address.)

(Authentication and seal of United States consul.)

Paragraph 3. Except as provided in section 11 of this regulation, each consignment containing any meat or product, the transportation of which to the United States from the foreign country of the slaughter of the animals from which it was derived has been interrupted by unloading in any other foreign country for some purpose other than transfer from one carrier to another in the course of continuous transportation to the United States, shall be accompanied by a certificate in the following form:

OFFICIAL MEAT INSPECTION CERTIFICATE OF COUNTRY OTHER THAN COUNTRY OF SLAUGHTER

(For shipment of meat and meat food products to United States not continuous from country of slaughter.)

Place............................ Date........................191 .
(City.) (Country.)

I hereby certify that the meat and meat food products herein described were originally shipped from..............................
(Country or countries of slaughter.)
and were accompanied by certificate (or certificates), signed by an official (or officials) of the national government (or governments) of
....
(Names of country or countries of origin.)
showing that the meat and meat food products herein described were derived from cattle, sheep, swine, or goats which received ante-mortem and post-mortem veterinary inspection at the time of slaughter, and that such meat and meat food products were sound, healthful, wholesome, and otherwise fit for human food, and had not been treated with, and did not contain, any preservative, coloring matter, or other substance not permitted by the regulations of the United States Secretary of Agriculture governing meat inspection filed with said official (or officials), and that said meat and meat food products had been handled only in a sanitary manner in the country (or countries) in which the animals from which they were derived were slaughtered.

I also hereby certify that the meat and meat food products herein described have not been treated in this country (in which this certificate is issued) with any preservative, coloring matter, or other substance not permitted by the regulations of the United States Secretary of Agriculture governing meat inspection, filed with me, and that the said meat and meat food products have been inspected in this country (in which this certificate is issued) and not found to be unsound, unhealthful, unwholesome, or otherwise unfit for human food, and that said meat and meat food products have been handled only in a sanitary manner in this country.

Kind of product.	Number of pieces or packages.	Weight
....	....	....
....	....	....
....	....	....
....	....	....

Identification marks on meats and packages ....
Consignor .... Address ....
Consignee .... Destination ....
Shipping marks ....

(Signature) ....
(Name of official of national foreign government authorized to issue inspection certificates for meat and meat food products exported to the United States.)
(Official title) ....

NOTE.—A certificate in the above form is required to accompany each consignment the transportation of which to the United States from the country of the slaughter of the animals from which the meat and meat food products were derived has been interrupted by unloading in another country for some purpose other than transfer from one carrier to another in the course of continuous transportation, and to be delivered by the consignee, or his agent, to the inspector of the Department of Agriculture at the point of inspection in the United States.

The following information is required to be supplied on the certificate by each carrier loading the consignment:

Loaded (in the country in which this certificate is issued) ....
(Date.)
at .... on ....
(Place.) (Name of vessel or car numbers and initials.)
.... ; and, if unloaded at any place
(Signature of officer or agent of carrier making indorsement.)
prior to arrival in the United States, unloaded ....
(Date.)
at .... by the ....
(Place.) (Name of carrier.)
.... ; and reloaded
(Signature of officer or agent of carrier making indorsement.)
.... at ....
(Date.) (Place.)
on .... by the ....
(Name of vessel or car numbers and initals.) (Name of carrier.)
....
(Signature of officer or agent of carrier making indorsement.)

Paragraph 4. Each foreign meat inspection certificate shall be signed by an official authorized by the national government of the foreign country in which the meat or product is inspected to sign and issue the same. The name of each official authorized to sign and issue foreign meat inspection certificates, when submitted to the department, will be published, and the chief of bureau shall file with each such official a copy of these regulations and copies of amendments which may hereafter be made thereto. No inspector shall accept a certificate unless it is signed by an official whose name has been published by the department and whose authority to sign certificates has not been revoked.

Paragraph 5. Each foreign meat inspection certificate shall be in the English language, and shall contain a statement of the number of pieces or packages, and the total weight of each kind of meat or product comprising the consignment, together with a description of the identification marks on the meat and products or on the packages containing the same, a description of the shipping marks, the name and address of the consignor, the name of the consignee, and the final destination of the consignment in the United States.

Paragraph 6. Each carrier that receives and loads into boats, cars, or other vehicles in any foreign country any consignment of meat and products for transportation to the United States shall indorse on the foreign meat inspection certificate accompanying it the date and place of loading, the name of the vessel, or the numbers and initials of the cars, in which loaded, and, if the consignment is unloaded at any place prior to arrival in the United States, the date and place of unloading. Every such indorsement shall be signed by the person making it, and he shall state on the certificate his official title and the name of the carrier for which he signs.

Paragraph 7. The foreign meat inspection certificate required by this section to accompany each consignment containing any meat or product shall be delivered by the consignee, or his agent, in the United States to the department inspector at the place of inspection, and inspection of the meat or product will not be commenced prior to such delivery.

Section 6. Each importer shall make application for inspection to the inspector in charge, if one be stationed at the port where any meat or product is to be offered for importation, or, if not, to the Chief of the Bureau of Animal Industry, Department of Agriculture, Washington, D. C., as long as possible in advance of the anticipated arrival of each consignment, except in the case of consignments of meat and products expressly exempted from inspection by section 11 of this regulation. Each application shall state the approximate date on which the consignment is due to arrive in the United States, the name of the boat or other carrier transporting it, the name of the country of the slaughter of the animals from which the meat and products were derived, the place of transshipment, if any, the place of destination, the quantity and kind of the product, and whether fresh, cured, or canned. In case of consignments arriving in the United States by water, the application should also state the port of first arrival in the United States.

SECTION 7. *Paragraph 1.* Except as provided in section 11 of this regulation, all meat and products offered for importation from any foreign country shall be inspected by a department inspector before the same shall be admitted into the United States.

Paragraph 2. All meat and products required by this regulation to be inspected, which arrive in the United States by water at any port where a department inspector is stationed, shall be inspected on the wharf at the time of unloading, except that if, upon the application of the consignee or his agent, the inspector in charge at such port shall so direct, the articles may be inspected at any other place within the limits of the port or elsewhere in the United States.

Paragraph 3. All meat and products required by this regulation to be inspected, which arrive in the United States by water at a port where no department inspector is stationed and which are consigned to any place where a department inspector is stationed, shall be inspected at destination.

Paragraph 4. All meat and products required by this regulation to be inspected, which arrive in the United States by water at a port where no department inspector is stationed and which are consigned to any place where no department inspector is stationed, shall be inspected at such place as the chief of bureau, on application of the consignee or his agent, or upon the request of the customs officer at the port of arrival, shall direct.

Paragraph 5. All meat and products required by this regulation to be inspected, which arrive in the United States otherwise than by water and which are consigned to any place where a department inspector is stationed, shall be inspected at destination.

Paragraph 6. All meat and products required by this regulation to be inspected, which arrive in the United States otherwise than by water and which are consigned to any place where no department inspector is stationed, shall be inspected at such place as the chief of bureau, on application of the consignee or his agent, or upon the request of the customs officer at the port of arrival, shall direct.

Paragraph 7. No meat or product required by this regulation to be inspected shall be moved, prior to inspection, from the port of first arrival in the United States, or, if arriving by water, from the wharf where unloaded, unless the same is conveyed in cars, wagons, or other vehicles, sealed, or in packages corded and sealed, in compliance with paragraph 8 of this section.

Paragraph 8. Cars, wagons, vehicles, or packages in which any meat or product is conveyed in accordance with this section, prior to inspection, from the port of first arrival in the United States, or, if arriving by water, from the wharf where unloaded, unless already sealed with customs or consular seals in accordance with the customs regulations, shall be sealed with special import meat seals of the Department of Agriculture. Packages shall be securely corded before being offered for sealing. Such special seals shall be affixed by department inspectors, or, if there be no department inspector at such port or wharf, then by customs officers.

Paragraph 9. Except customs officers and department inspectors, no person shall affix, break, alter, deface, mutilate, remove, or destroy any special import meat seal of the Department of Agriculture.

Paragraph 10. No meat or product shall be removed from any car, wagon, vehicle, or package sealed with a special import meat seal of the Department of Agriculture except under the supervision of a department inspector or a customs officer.

Paragraph 11. No meat or product required by this regulation to be inspected shall be moved, prior to inspection, from any port, or, if arriving by water, from the wharf where first unloaded, to any place other than the place designated by, or in accordance with, this section as the place where the same shall be inspected.

Paragraph 12. No meat or product required by this regulation to be inspected shall be conveyed, prior to inspection, from any port, or, if arriving by water, from the wharf where first unloaded, in any manner other than in compliance with this section.

Paragraph 13. No meat or product required by this regulation to be inspected shall be delivered to the consignee or his agent prior to inspection, unless the consignee shall furnish a bond, in form prescribed by the Secretary of the Treasury, conditioned that the meat or product shall be returned, if demanded, to the collector of the port where the same is offered for clearance through the customs.

Paragraph 14. The consignee or his agent shall furnish such facilities and shall provide such assistants for handling and marking meat and products offered for importation as department inspectors may require.

SECTION 8. Compartments of steamships, sailing vessels, railroad cars, and other conveyances transporting any meat or product to the United States, and all trucks, chutes, platforms, racks, tables, tools, utensils, and all other devices used in moving and handling any meat or product offered for importation into the United States shall be maintained in a sanitary condition.

SECTION 9. *Paragraph 1.* Department inspectors shall take, without cost to the United States, from each consignment offered for importation, samples of any meat or product which is subject to chemical analysis, except that samples of any meat or product offered for importation without inspection under section 11 of this regulation shall not be taken unless there is reason for suspecting the presence therein of a substance in violation of that section.

Paragraph 2. If the inspection of samples indicates that any meat or product offered for importation into the United States is unsound, unhealthful, unwholesome, or otherwise unfit for human food, a thorough inspection of the whole consignment from which the samples were taken shall be made.

Paragraph 3. Carcasses and parts of carcasses offered for importation from which such tissues as the peritoneum, pleura, body lymph glands, or the portal glands of the liver have been removed, shall be condemned.

Paragraph 4. Any meat or product offered for importation which is found upon inspection to be unsound, unhealthful, unwholesome, or otherwise unfit for human food, or to contain any dye, chemical, preservative or ingredient not permitted by regulation 18, or which is of a kind required by paragraph 1 of section 3 of this regulation to be refused admission, shall be condemned and marked "U. S. inspected and condemned," except that, upon application to the inspector, any meat or product which is found to contain preservatives not permitted by these regulations, but in the preparation or packing of which no substance has been used in conflict with the laws of the foreign country from which exported, and which is not found to be otherwise unsound, unhealthful, unwholesome, or unfit for human food, may be marked "U. S. refused entry."

Paragraph 5. Any meat or product, or the container thereof, offered for importation from any foreign country and accompanied by a foreign certificate of inspection as required by this regulation, which, upon inspection by department inspectors, is not found to be unsound, unhealthful, unwholesome, or otherwise unfit for human food, or to contain any dye, chemical, preservative, or ingredient not permitted by regulation 18, or to violate this regulation in any respect, shall be marked "U. S. inspected and passed by Department of Agriculture" and with the official name or abbreviation of the station to which the inspector is assigned. All meat and products so marked, in compliance with this regulation, shall, so far as the Department of Agriculture has jurisdiction over the same, be admitted into the United States.

Paragraph 6. Department inspectors shall report their findings as to any meat or product which has been inspected, in accordance with this regulation, to the collector at the port where the same is offered for clearance through the customs, and shall request the collector to refuse admission to all meat and products which are marked either "U. S. inspected and condemned" or "U. S. refused entry," and to direct that the same be exported by the consignee within a specified time, unless the consignee, within such specified time, shall cause the destruction thereof for food purposes under the supervision of a department inspector. Such specified time shall be 30 days after such notice to customs officers, unless a different time be fixed by the Secretary of Agriculture upon application to him. If any such meat or product be destroyed for food purposes under the supervision of a department inspector, he shall give prompt notice thereof to the collector.

Paragraph 7. Upon the request of the collector, consignees shall, at their own expense, immediately return to him any meat or product which is marked either "U. S. inspected and condemned," or "U. S. refused entry," or which, in any respect, does not comply with this regulation. All such meat and products shall be conveyed in cars, wagons, or other vehicles, or in corded packages, sealed with the special import meat seal of the Department of Agriculture.

Paragraph 8. No person shall remove or cause to be removed from any place designated by, or in accordance with, these regulations as a place of inspection, any meat or product which these regulations require to be marked in any way, unless the same has been clearly and legibly marked in compliance with these regulations.

Paragraph 9. The marks required by paragraphs 4 and 5 of this section shall be applied by branding to carcasses and parts of carcasses offered for importation which are unwrapped or not inclosed in a container. Not less than one brand shall be applied to each quarter of a beef carcass.

SECTION 10. *Paragraph 1.* Cans, tins, pots, glass, and wrappers of paper, wood, or similar material containing any meat or product offered for importation shall be marked as required by this section.

Paragraph 2. To all true containers there shall be securely affixed labels bearing the true name of the product, the name of the manufacturer, and the place where prepared. There shall be on each true container a space for the application of the inspection legend and other marks required by paragraph 3 of this section. When true containers are placed within other containers, the outside container shall be marked with the true name of the meat or product.

Paragraph 3. (*a*) All outside containers of meat and products which have been inspected and passed in compliance with this regulation shall be marked by the inspector, or under his supervision, "U. S. inspected and passed by Department of Agriculture" and with the official name or abbreviation of the station to which the inspector is assigned.

(*b*) All true containers of meat and products which have been inspected and passed in compliance with this regulation, and which are to be removed from the outside containers and thereafter to be transported in interstate or foreign commerce or to an official establishment, shall be marked by the inspector, or under his supervision, by means of labels or stickers securely affixed thereto, "U. S. inspected and passed by Department of Agriculture" and with the official name or abbreviation of the station to which the inspector is assigned.

(*c*) To each true container of imported meat and products received at an official establishment and there removed from an outside container there shall be securely affixed, before the same shall be allowed to leave the establishment, a label or sticker bearing the inspection legend "U. S. inspected and passed by Department of Agriculture" and the establishment number.

SECTION 11. *Paragraph 1.* Any meat or product offered for importation in small quantity exclusively for the personal use of the consignee, and not for sale or distribution, which is sound, healthful, wholesome, and fit for human food, and contains no dye, chemical, preservative, or ingredient not permitted by regulation 18, and which is not adulterated or misbranded within the meaning of the food and drugs act as amended, may be admitted into the United States without foreign meat inspection certificates and without inspection and marking; but department inspectors may inspect any meat or product offered for importation under this paragraph if there is reason for suspecting that it is unsound, unhealthful, unwholesome, or otherwise unfit for food, or contains any dye, chemical, preservative, or ingredient not permitted by regulation 18, or is adulterated or misbranded within the meaning of the food and drugs act as amended.

Paragraph 2. No meat or product offered for importation under paragraph 1 of this section shall be admitted into the United States if it is unsound, unhealthful, unwholesome, or otherwise unfit for human food, or if it contains any dye, chemical, preservative, or ingredient not permitted by regulation 18, or if it is adulterated or misbranded within the meaning of the food and drugs act as amended.

Paragraph 3. No carrier or other person shall transport or receive for transportation from one State or Territory or the District of Columbia to or through any other State, Territory, or the District of Columbia, or to any place under the jurisdiction of the United States, any meat or product exempted from inspection and admitted into the United States in compliance with this section unless the shipper shall make and deliver to the carrier a certificate in duplicate in the following form:[1]

Date........................, 191 .

Name of carrier ....
Shipper ....
Point of shipment ....
Consignee ....
Destination ....

I hereby certify that the following described uninspected meat or meat food products, offered for transportation in interstate commerce, were imported into the United States exclusively for the personal use of the consignee, and not for sale or distribution, and are exempted from inspection by the regulations of the United States Secretary of Agriculture governing meat inspection.

Kind of product.	Amount and weight.
....	....
....	....
....	....

....
(Signature of shipper.)

....
(Address of shipper.)

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[1] For convenience in filing it is requested that these certificates be made on paper 5½ by 8 inches in size.

The signature of the shipper or of his agent shall be written in full. This certificate shall be separate and apart from any waybill, bill of lading, or other form ordinarily used in the shipment of meat. The duplicate certificate shall be forwarded immediately by the initial carrier to the Chief of the Bureau of Animal Industry, Washington, D. C. All waybills, transfer bills, running slips, or conductor's cards accompanying an interstate shipment of any meat or product transported in compliance with this section shall have embodied therein, stamped thereon, or attached thereto a signed statement which shall be evidence to connecting carriers that the shipper's certificate required by this section is on file with the initial carrier; and no connecting carrier shall receive for transportation or transport any interstate shipment of any meat or product under this section unless the waybill, transfer bill, running slip, or conductor's card accompanying the same includes the aforesaid signed statement, in the following form:

(Name of transportation company.)

Imported for the personal use of consignee and exempt from inspection, as evidenced by shipper's certificate on file with initial carrier.

(Signed) .... *Agent.*

The signature of the agent shall be written in full.

SECTION 12. *Paragraph 1.* All imported meat and products, after admission into the United States in compliance with this regulation, shall be deemed and treated, and, except as provided in paragraph 3 of section 11 of this regulation, shall be handled and transported, as domestic meat and products, and shall be subject to all these regulations and to the provisions, prohibitions, and penalties of the meat inspection act.

Paragraph 2. Imported meat and products inspected, passed, and marked in accordance with this regulation may, subject to the provisions of paragraph 1 of section 3 of regulation 18, be taken into official establishments and be mixed with or added to meat and products in such establishments which have been inspected and passed therein.

Paragraph 3. Imported meat and products which have been inspected, passed, and marked under this regulation may be transported from one State or Territory or the District of Columbia to or through another State or Territory or the District of Columbia, or to any place under the jurisdiction of the United States, or to a foreign country, only upon compliance with regulation 25.

LAWS UNDER WHICH THE FOREGOING REGULATIONS ARE MADE

THE MEAT INSPECTION ACT

Extract from an act of Congress entitled "An act making appropriations for the Department of Agriculture for the fiscal year ending June thirtieth, nineteen hundred and seven," approved June 30, 1906 (34 Stat. 674), and from an act of Congress entitled "An act making appropriations for the Department of Agriculture for the fiscal year ending June thirtieth, nineteen hundred and eight," approved March 4, 1907 (34 Stat. 1260).

[1] That [hereafter,][1] for the purpose of preventing the use in interstate or foreign commerce, as hereinafter provided, of meat and meat food products which are unsound, unhealthful, unwholesome, or otherwise unfit for human food, the Secretary of Agriculture, at his discretion, may cause to be made, by inspectors appointed for that purpose, an examination and inspection of all cattle, sheep, swine, and goats before they shall be allowed to enter into any slaughtering, packing, meat-canning, rendering, or similar establishment, in which they are to be slaughtered and the meat and meat food products thereof are to be used in interstate or foreign commerce; and all cattle, swine, sheep, and goats found on such inspection to show symptoms of disease shall be set apart and slaughtered separately from all other cattle, sheep, swine, or goats, and when so slaughtered the carcasses of said cattle, sheep, swine, or goats shall be subject to a careful examination and inspection, all as provided by the rules and regulations to be prescribed by the Secretary of Agriculture as herein provided for.

[2] That for the purpose hereinbefore set forth the Secretary of Agriculture shall cause to be made by inspectors appointed for that purpose, as hereinafter provided, a post-mortem examination and inspection of the carcasses and parts thereof of all cattle, sheep, swine, and goats to be prepared for human consumption at any slaughtering, meat-canning, salting, packing, rendering, or similar establishment in any State, Territory, or the District of Columbia for transportation or sale as articles of interstate or foreign commerce; and the carcasses and parts thereof of all such animals found to be sound, healthful, wholesome, and fit for human food shall be marked, stamped, tagged, or labeled as "Inspected and Passed"; and said inspectors shall label,

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[1] The word "hereafter" is used in the act of 1907 but not in that of 1906. Otherwise the extract here given is identical in both laws.

mark, stamp, or tag as "Inspected and Condemned," all carcasses and parts thereof of animals found to be unsound, unhealthful, unwholesome, or otherwise unfit for human food; and all carcasses and parts thereof thus inspected and condemned shall be destroyed for food purposes by the said establishment in the presence of an inspector, and the Secretary of Agriculture may remove inspectors from any such establishment which fails to so destroy any such condemned carcass or part thereof, and said inspectors, after said first inspection shall, when they deem it necessary, reinspect said carcasses or parts thereof to determine whether since the first inspection the same have become unsound, unhealthful, unwholesome, or in any way unfit for human food, and if any carcass or any part thereof shall, upon examination and inspection subsequent to the first examination and inspection, be found to be unsound, unhealthful, unwholesome, or otherwise unfit for human food, it shall be destroyed for food purposes by the said establishment in the presence of an inspector and the Secretary of Agriculture may remove inspectors from any establishment which fails to so destroy any such condemned carcass or part thereof.

[3] The foregoing provisions shall apply to all carcasses or parts of carcasses of cattle, sheep, swine, and goats, or the meat or meat products thereof which may be brought into any slaughtering, meat-canning, salting, packing, rendering, or similar establishment, and such examination and inspection shall be had before the said carcasses or parts thereof shall be allowed to enter into any department wherein the same are to be treated and prepared for meat food products; and the foregoing provisions shall also apply to all such products which, after having been issued from any slaughtering, meat-canning, salting, packing, rendering, or similar establishment, shall be returned to the same or to any similar establishment where such inspection is maintained.

[4] That for the purposes hereinbefore set forth the Secretary of Agriculture shall cause to be made by inspectors appointed for that purpose an examination and inspection of all meat food products prepared for interstate or foreign commerce in any slaughtering, meat-canning, salting, packing, rendering, or similar establishment, and for the purposes of any examination and inspection said inspectors shall have access at all times, by day or night, whether the establishment be operated or not, to every part of said establishment; and said inspectors shall mark, stamp, tag, or label as "Inspected and Passed" all such products found to be sound, healthful, and wholesome, and which contain no dyes, chemicals, preservatives, or ingredients which render such meat or meat food products unsound, unhealthful, unwholesome, or unfit for human food; and said inspectors shall label, mark, stamp, or tag as "Inspected and Condemned" all such products found unsound, unhealthful, and unwholesome, or which contain dyes, chemicals, preservatives, or ingredients which render such meat or meat food products unsound, unhealthful, unwholesome, or unfit for human food, and all such con-

demned meat food products shall be destroyed for food purposes, as hereinbefore provided, and the Secretary of Agriculture may remove inspectors from any establishment which fails to so destroy such condemned meat food products: *Provided,* That, subject to the rules and regulations of the Secretary of Agriculture, the provisions hereof in regard to preservatives shall not apply to meat food products for export to any foreign country and which are prepared or packed according to the specifications or directions of the foreign purchaser, when no substance is used in the preparation or packing thereof in conflict with the laws of the foreign country to which said article is to be exported; but if said article shall be in fact sold or offered for sale for domestic use or consumption, then this proviso shall not exempt said article from the operation of all the other provisions of this act.

[5] That when any meat or meat food product prepared for interstate or foreign commerce which has been inspected as hereinbefore provided and marked "Inspected and Passed" shall be placed or packed in any can, pot, tin, canvas, or other receptacle or covering in any establishment where inspection under the provisions of this act is maintained, the person, firm, or corporation preparing said product shall cause a label to be attached to said can, pot, tin, canvas, or other receptacle or covering, under the supervision of an inspector, which label shall state that the contents thereof have been "Inspected and Passed" under the provisions of this act; and no inspection and examination of meat or meat food products deposited or inclosed in cans, tins, pots, canvas, or other receptacle or covering in any establishment where inspection under the provisions of this act is maintained shall be deemed to be complete until such meat or meat food products have been sealed or inclosed in said can, tip, pot, canvas, or other receptacle or covering under the supervision of an inspector, and no such meat or meat food products shall be sold or offered for sale by any person, firm, or corporation in interstate or foreign commerce under any false or deceptive name; but established trade name or names which are usual to such products and which are not false and deceptive and which shall be approved by the Secretary of Agriculture are permitted.

[6] The Secretary of Agriculture shall cause to be made, by experts in sanitation or by other competent inspectors, such inspection of all slaughtering, meat-canning, salting, packing, rendering, or similar establishments in which cattle, sheep, swine, and goats are slaughtered and the meat and meat food products thereof are prepared for interstate or foreign commerce as may be necessary to inform himself concerning the sanitary conditions of the same, and to prescribe the rules and regulations of sanitation under which such establishments shall be maintained; and where the sanitary conditions of any such establishment are such that the meat or meat food products are rendered unclean, unsound, unhealthful, unwholesome, or otherwise unfit for human food, he shall

refuse to allow said meat or meat food products to be labeled, marked, stamped, or tagged as "Inspected and Passed."

[7] That the Secretary of Agriculture shall cause an examination and inspection of all cattle, sheep, swine, and goats, and the food products thereof, slaughtered and prepared in the establishments hereinbefore described for the purposes of interstate or foreign commerce to be made during the nighttime as well as during the daytime when the slaughtering of said cattle, sheep, swine, and goats, or the preparation of said food products is conducted during the nighttime.

[8] That on and after October first, nineteen hundred and six, no person, firm, or corporation shall transport or offer for transportation, and no carrier of interstate or foreign commerce shall transport or receive for transportation from one State or Territory or the District of Columbia to any other State or Territory or the District of Columbia, or to any place under the jurisdiction of the United States, or to any foreign country, any carcasses or parts thereof, meat, or meat food products thereof which have not been inspected, examined, and marked as "Inspected and Passed," in accordance with the terms of this act and with the rules and regulations prescribed by the Secretary of Agriculture: *Provided,* That all meat and meat food products on hand on October first, nineteen hundred and six, at establishments where inspection has not been maintained, or which have been inspected under existing law, shall be examined and labeled under such rules and regulations as the Secretary of Agriculture shall prescribe, and then shall be allowed to be sold in interstate or foreign commerce.

[9] That no person, firm, or corporation, or officer, agent, or employe thereof, shall forge, counterfeit, simulate, or falsely represent, or shall without proper authority use, fail to use, or detach, or shall knowingly or wrongfully alter, deface, or destroy, or fail to deface or destroy, any of the marks, stamps, tags, labels, or other identification devices provided for in this act, or in and as directed by the rules and regulations prescribed hereunder by the Secretary of Agriculture, on any carcasses, parts of carcasses, or the food product or containers thereof, subject to the provisions of this act, or any certificate in relation thereto, authorized or required by this act or by the said rules and regulations of the Secretary of Agriculture.

[10] That the Secretary of Agriculture shall cause to be made a careful inspection of all cattle, sheep, swine, and goats intended and offered for export to foreign countries at such times and places, and in such manner as he may deem proper, to ascertain whether such cattle, sheep, swine, and goats are free from disease.

[11] And for this purpose he may appoint inspectors who shall be authorized to give an official certificate clearly stating the condition in which such cattle, sheep, swine, and goats are found.

[12] And no clearance shall be given to any vessel having on board cattle, sheep, swine, or goats for export to a foreign country until the owner or shipper of such cattle, sheep, swine, or goats has a certificate from the inspector herein authorized to be appointed, stating that the said cattle, sheep, swine, or goats are sound and healthy, or unless the Secretary of Agriculture shall have waived the requirement of such certificate for export to the particular country to which such cattle, sheep, swine, or goats are to be exported.

[13] That the Secretary of Agriculture shall also cause to be made a careful inspection of the carcasses and parts thereof of all cattle, sheep, swine, and goats, the meat of which, fresh, salted, canned, corned, packed, cured, or otherwise prepared, is intended and offered for export to any foreign country, at such times and places and in such manner as he may deem proper.

[14] And for this purpose he may appoint inspectors who shall be authorized to give an official certificate stating the condition in which said cattle, sheep, swine, or goats, and the meat thereof, are found.

[15] And no clearance shall be given to any vessel having on board any fresh, salted, canned, corned, or packed beef, mutton, pork, or goat meat, being the meat of animals killed after the passage of this act, or except as hereinbefore provided for export to and sale in a foreign country from any port in the United States, until the owner or shipper thereof shall obtain from an inspector appointed under the provisions of this act a certificate that the said cattle, sheep, swine, and goats were sound and healthy at the time of inspection, and that their meat is sound and wholesome, unless the Secretary of Agriculture shall have waived the requirements of such certificate for the country to which said cattle, sheep, swine, and goats or meats are to be exported.

[16] That the inspectors provided for herein shall be authorized to give official certificates of the sound and wholesome condition of the cattle, sheep, swine, and goats, their carcasses and products as herein described, and one copy of every certificate granted under the provisions of this act shall be filed in the Department of Agriculture, another copy shall be delivered to the owner or shipper, and when the cattle, sheep, swine, and goats or their carcasses and products are sent abroad, a third copy shall be delivered to the chief officer of the vessel on which the shipment shall be made.

[17] That no person, firm, or corporation engaged in the interstate commerce of meat or meat food products shall transport or offer for transportation, sell or offer to sell any such meat or meat food products in any State or Territory or in the District of Columbia or any place under the jurisdiction of the United States, other than in the State or Territory or in the District of Columbia or any place under the jurisdiction of the United States in which the slaughtering, packing, canning, rendering, or other similar establishment owned, leased, operated by

said firm, person, or corporation is located unless and until said person, firm, or corporation shall have complied with all of the provisions of this act.

[18] That any person, firm, or corporation, or any officer or agent of any such person, firm, or corporation, who shall violate any of the provisions of this act shall be deemed guilty of a misdemeanor, and shall be punished on conviction thereof by a fine of not exceeding $10,000 or imprisonment for a period not more than 2 years, or by both such fine and imprisonment, in the discretion of the court.

[19] That the Secretary of Agriculture shall appoint from time to time inspectors to make examination and inspection of all cattle, sheep, swine, and goats, the inspection of which is hereby provided for, and of all carcasses and parts thereof, and of all meats and meat food products thereof, and of the sanitary conditions of all establishments in which such meat and meat food products hereinbefore described are prepared; and said inspectors shall refuse to stamp, mark, tag, or label any carcass or any part thereof, or meat food product therefrom, prepared in any establishment hereinbefore mentioned, until the same shall have actually been inspected and found to be sound, healthful, wholesome and fit for human food, and to contain no dyes, chemicals, preservatives, or ingredients which render such meat food product unsound, unhealthful, unwholesome, or unfit for human food; and to have been prepared under proper sanitary conditions, hereinbefore provided for; and shall perform such other duties as are provided by this act and by the rules and regulations to be prescribed by said Secretary of Agriculture; and said Secretary of Agriculture shall, from time to time, make such rules and regulations as are necessary for the efficient execution of the provisions of this act, and all inspections and examinations made under this act shall be such and made in such manner as described in the rules and regulations prescribed by said Secretary of Agriculture not inconsistent with the provisions of this act.

[20] That any person, firm, or corporation, or any agent or employe of any person, firm, or corporation, who shall give, pay, or offer, directly or indirectly, to any inspector, deputy inspector, chief inspector, or any other officer or employe of the United States authorized to perform any of the duties prescribed by this act or by the rules and regulations of the Secretary of Agriculture any money or other thing of value, with intent to influence said inspector, deputy inspector, chief inspector, or other officer or employe of the United States in the discharge of any duty herein provided for, shall be deemed guilty of a felony and, upon conviction thereof, shall be punished by a fine not less than $5,000 nor more than $10,000 and by imprisonment not less than 1 year nor more than 3 years; and any inspector, deputy inspector, chief inspector, or other officer or employe of the United States authorized to perform any of the duties prescribed by this act who shall accept any money, gift, or other thing of value from any person,

firm, or corporation, or officers, agents, or employes thereof, given with intent to influence his official action, or who shall receive or accept from any person, firm, or corporation engaged in interstate or foreign commerce any gift, money, or other thing of value given with any purpose or intent whatsoever, shall be deemed guilty of a felony and shall, upon conviction thereof, be summarily discharged from office and shall be punished by a fine not less than $1,000 nor more than $10,000 and by imprisonment not less than 1 year nor more than 3 years.

[21] That the provisions of this act requiring inspection to be made by the Secretary of Agriculture shall not apply to animals slaughtered by any farmer on the farm and sold and transported as interstate or foreign commerce, nor to retail butchers and retail dealers in meat and meat food products, supplying their customers: *Provided,* That if any person shall sell or offer for sale or transportation for interstate or foreign commerce any meat or meat food products which are diseased, unsound, unhealthful, unwholesome, or otherwise unfit for human food, knowing that such meat food products are intended for human consumption, he shall be guilty of a misdemeanor, and on conviction thereof shall be punished by a fine not exceeding $1,000 or by imprisonment for a period of not exceeding 1 year, or by both such fine and imprisonment: *Provided, also,* That the Secretary of Agriculture is authorized to maintain the inspection in this act provided for at any slaughtering, meat-canning, salting, packing, rendering, or similar establishment notwithstanding this exception, and that the persons operating the same may be reteail butchers and retail dealers or farmers; and where the Secreteary of Agriculture shall establish such inspection then the provisions of this act shall apply notwithstanding this exception.

THE IMPORTED MEAT ACT

Extract from an act of Congress entitled "An act to reduce tariff duties and to provide revenue for the Government, and for other purposes," approved October 3, 1913 (38 Stat. 114, 152, 159).

That on and after the day following the passage of this act, except as otherwise specifically provided for in this act, the articles mentioned in the following paragraphs shall when imported into the United States or into any of its possessions (except the Philippine Islands and the Islands of Guam and Tutuila) be exempt from duty:

* * * * * * *

545. Meats: Fresh beef, veal, mutton, lamb, and pork; bacon and hams; meats of all kinds, prepared or preserved, not specially provided for in this section: *Provided, however,* That none of the foregoing meats shall be admitted into the United States unless the same is healthful, wholesome, and fit for human food and contains no dye, chemical, preservative, or ingredient which renders the same unhealthful, unwholesome, or unfit for human food, and unless the same also complies with the rules and regulations made by the Secretary of Agricul-

ture, and that, after entry into the United States in compliance with said rules and regulations, said imported meats shall be deemed and treated as domestic meats within the meaning of and shall be subject to the provisions of the act of June thirtieth, nineteen hundred and six (Thirty-fourth Statutes at Large, page six hundred and seventy-four), commonly called the meat inspection amendment, and the act of June thirtieth, nineteen hundred and six (Thirty-fourth Statutes at Large, page seven hundred and sixty-eight), commonly called the food and drugs act, and that the Secretary of Agriculture be and hereby is authorized to make rules and regulations to carry out the purposes of this paragraph, and that in such rules and regulations the Secretary of Agriculture may prescribe the terms and conditions for the destruction for food purposes of all such meats offered for entry and refused admission into the United States unless the same be exported by the consignee within the time fixed therefor in such rules and regulations.

AMENDMENT 1 TO REGULATION 27, B. A. I. ORDER 211

Paragraph 8. Except as provided in section 11 of this regulation, each consignment of any meat or product of a kind prepared customarily to be eaten without cooking (such as summer sausage, "Italian" and "Westphalia" hams, and the like), which contains any muscle tissue of pork, shall be accompanied, in addition to any other certificate required by this section, by a separate foreign meat-inspection certificate in the following form:

OFFICIAL MEAT INSPECTION CERTIFICATE FOR PORK AND PORK PRODUCTS

(For shipment to the United States of articles of a kind prepared customarily to be eaten without cooking, which contain muscle tissue of pork.)

Place................. (City.) .... (Country.) Date............191 .

I hereby certify that the article or articles herein described are of a kind prepared customarily to be eaten without cooking, and contain muscle tissue of pork, which, when fresh or freshly cured in salt, was subjected to a temperature not higher than 12° F. for not less than 20 days, and that said article or articles contain no muscle tissue of pork which has not been treated as herein specified.

Kind of product.	Number of pieces or packages.	Weight.
....	....	....
....	....	....
....	....	....

Identification marks on meats and packages ....

Consignor .... Address ....

Consignee .... Destination ....

Shipping marks ....

(Signature) ....

(Name of official of national foreign government authorized to issue inspection certificates for meat and meat food products exported to the United States.)

(Official title) ....

NOTE.—A certificate in the above form is required to accompany each consignment of any meat or product of a kind prepared customarily to be eaten without cooking (such as summer sausage, "Italian" and "Westphalia" hams, and the like), which contains any muscle tissue of pork. This certificate is to be delivered by the consignee, or his agent, to the inspector of the Department of Agriculture at the point of inspection in the United States.

Each such foreign meat inspection certificate shall be subject to the provisions of paragraphs 4 to 7, inclusive, of this section.

AMENDMENT 2 TO REGULATIONS 8, 10, 15, 17, 18, AND 25, B. A. I. ORDER 21

Regulation 8, section 3, paragraph 8.—Dogs shall not be admitted into official establishments.

Regulation 10, section 8, paragraph 3.—Skins and hides from animals condemned for tuberculosis or any disease communicable to man or other animal may be removed from the establishment, except as provided in section 2 of regulation 11, for tanning or other industrial use; but they shall be removed for these uses only after disinfection as follows: Each skin or hide shall be immersed for not less than 5 minutes in a 5 per cent. solution of liquor cresolis compositus, or a 5 per cent. solution of carbolic acid, or for not less than 4 hours in a mixture composed of 1 part of bichloride of mercury to 1,000 parts of salt solution containing not less than 15 per cent. of sodium chloride. The process of skinning and dipping shall be conducted entirely in the retaining room, or other specially prepared place approved by the inspector in charge, and under the supervision of a bureau employe.

Regulation 15, section 3, paragraph 2.—Any carcasses or parts prepared in compliance with paragraph 1 of this section, whether canned or placed in other approved container or not, shall be plainly and conspicuously marked "Prepared from meat passed for sterilization."

Regulation 17, section 9, paragraph 10.—When permitted coloring matter is used in the preparation of lard or other prepared animal fats under the provisions of paragraph 3 of section 6 of regulation 18 there shall appear on the label in a prominent manner and contiguous to the name of the product, except in the case of oleomargarin, the statement "artificially colored."

Regulation 18, section 3, paragraph 2.—Except persons having unrevoked certificates of exemption and farmers slaughtering animals on the farm, who comply with the provisions of regulation 25, applicable to them, no person who slaughters cattle, sheep, swine, or goats, or processes any meat or product, in an estabishment not having inspection in compliance with these regulations, shall transport or offer for transportation or cause or permit to be transported or offered for transportation any meat or product from such unofficial establishment in interstate or foreign commerce, or bring the same into an official establishment: *Provided, however,* That inspected and passed lard, canned meat, and oleomargarin, which has not been removed from and is in the immediate or true containers, may be transported in interstate or foreign commerce from such unofficial establishment if no product of the kind so transported is prepared or processed in the establishment, and the immediate or true containers bear the inspection legend and the articles are sound, healthful, wholesome, and fit for human food: *And provided further,* That fresh meats and unmelted fresh fats which have been inspected and passed and which bear the inspection legend may be brought from any such unofficial establishment into official establishments in the same State, Territory, or District when such meats or fats are found upon reinspection to be sound, healthful, wholesome, and fit for human food.

Regulation 25, section 4, paragraph 3.—Jobbers, wholesalers, and others who operate establishments in which slaughtering or processing is done, without the inspection provided for in these regulations, and who receive meat and products which have not been processed, other than under inspection in compliance with these regulations, may ship from such establishment, in interstate or foreign commerce under section 5 of this regulation, inspected and passed lard, canned meat, and oleomargarin which has not been removed from and is in the immediate or true containers: *Provided,* that no product of the kind so transported is prepared or processed in the establishment, and that the immediate or true containers bear the inspection legend, and that the articles are sound, healthful, wholesome, and fit for human food.

Regulation 25, section 12a.—When inedible grease or tallow or other inedible article derived wholly or in part from cattle, sheep, swine, or goats, suitable only for industrial use, is of such a nature or for such an industrial use that it is impracticable to denature the same and the product is shipped by an executive department or commission of the United States Government, such product may be transported from one State or Territory or the District of Columbia to or through another State or Territory or the District of Columbia, or to any place under the jurisdiction of the United States, without denaturing, provided the other provisions of this section are complied with. The carrier shall require, and the executive department or commission shall make and deliver to the carrier, a certificate in duplicate in the following form:

Date........................, 191 .

INEDIBLE FAT

Name of carrier ....
Consignor ....
Point of shipment ....
Consignee ....
Destination ....

The following-described fat is not capable of being used as food by man, is suitable only for industrial purposes, is not for food purposes, and is shipped by the United States Government.

Kind of product.	Amount and weight.
....	....
....	....
....	....

....
(Name of department or commission.)
By..
(Name and official title of officer or employe.)

The signature of the officer or employe tendering the consignment for shipment shall be written in full. This certificate shall be separate and apart from any waybill, bill of lading, or other form ordinarily used in the transportation of meat. The duplicate certificate shall be forwarded immediately by the initial carrier to the Chief of the Bureau of Animal Industry, Washington, D. C.

As evidence to connecting carriers that the proper shipper's certificate is on file with the initial carrier, the waybills, transfer bills, running slips, or conductor's cards accompanying such shipment shall have embodied therein, stamped thereon, or attached thereto a signed statement in the following form:

(Name of transportation company.)

Inedible, suitable only for industrial purposes, by the Government, as evidenced by shipper's certificate on file with initial carrier.

(Signed) .... *Agent.*

AMENDMENT 3 TO REGULATION 9, B. A. I. ORDER 211 (REGULATIONS GOVERNING THE MEAT INSPECTION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE)

Regulation 9, section 2, paragraph 5.—Animals which are offered for ante-mortem inspection under this regulation, and which are regarded as immature, shall be marked "U. S. Suspect," and if slaughtered the disposition of their carcasses shall be determined by the post-mortem findings in conjunction with the ante-mortem conditions. If not slaughtered as suspects, such animals shall be held under Bureau supervision and after sufficient development may be released for slaughter, or may be released for any other purpose, provided they have not been exposed to any infectious or contagious disease. Animals found dead or in a dying condition on premises of an official establishment shall be marked "U. S. Condemned" and disposed of in accordance with section 8 of this regulation.

AMENDMENT 4 TO REGULATIONS 4, 9, 10, 11, 16, 18, 25, AND 27, B. A. I. ORDER 211 (REGULATIONS GOVERNING THE MEAT INSPECTION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE)

Section 6, regulation 4; sections 12 and 12–A, regulation 25; and paragraph 6, section 3, regulation 27, of B. A. I. Order 211, containing the regulations governing the meat inspection of the United States Department of Agriculture, are hereby revoked.

Regulation 9, section 7, paragraph 3.—A hog suspected of being affected with hog cholera or swine plague may be set apart and held, under bureau supervision, for treatment with anti-hog-cholera serum. If at the expiration of the treatment period the animal upon examination is found to be free from disease it may be released for any purpose.

Regulation 9, section 8.—Except as hereinafter provided in this section, animals marked "U. S. condemned" shall be killed by the establishment, if not already dead, and shall not be taken into an establishment to be slaughtered or dressed; nor shall they be conveyed into any department of the establishment used for edible products; but they shall be disposed of and tanked in the manner provided for condemned carcasses in regulation 14. The "U. S. condemned" tag shall not be removed from, but shall remain on, the animal when it goes into the tank. The number of such tag shall be reported to the inspector in charge by the bureau employe who affixed it, and also by the bureau employe who supervises the tanking of the animal; provided, that any animal condemned on account of hog cholera or swine plague, as prescribed in paragraphs 1, 2, or 3 of section 2 of this regulation, may be set apart and held, under bureau supervision, for treatment with anti-hog-cholera serum, the requirement that such animal be killed shall be held in abeyance to await the result of the treatment. If at the expiration of the treatment period the animal upon examination is found to be free from disease, the "U. S. condemned" tag shall be removed and the animal released for any purpose.

Regulation 10, section 8, paragraph 3.—The skins from swine condemned for tuberculosis or any disease communicable to man or other animal may be removed from the establishment, except as provided in section 2 of regulation 11, for tanning or other industrial use; but they shall be removed for these uses only after they have been disinfected, as follows: Each skin shall be immersed for not less than 5 minutes in a 5 per cent. solution of liquor cresolis compositus, or a 5 per cent. solution of carbolic acid, or shall be immersed for not less than 4 hours in a mixture composed of 1 part of bichloride of mercury to 1,000 parts of a chloride of sodium (common salt) solution which is of at least 15 per cent. strength, or shall be otherwise treated as prescribed by the chief of the bureau. The process of skinning and disinfecting shall be conducted in the retaining room or other specially prepared place approved by the inspector in charge, and under the supervision of a bureau employe.

Regulation 11, section 3, paragraph 2, rule B (d).—Heads showing lesions of tuberculosis shall be condemned, except that when a head is from a carcass passed for food or for sterilization and the lesions are slight, or calcified, or encapsulated, and are confined to lymph glands in which not more than two glands are involved, the head may be passed for sterilization after the diseased tissues have been removed and condemned.

Regulation 11, section 4, paragraph 1.—The carcasses of all hogs marked as suspects on ante-mortem inspection shall be given careful post-mortem inspection; and if it appears that they are affected with either acute hog cholera or swine plague, they shall be disposed of in accordance with paragraph 2 of this section.

Regulation 11, section 5, paragraph 3.—Heads affected with actinomycosis (lumpy jaw), including the tongue, shall be condemned, except that when the disease of the jaw is slight, strictly localized, and without suppuration, fistulous tracts, or lymph-gland involvement, the tongue, if free from disease, may be passed, or, when the disease is slight and confined to the lymph glands, the head, including the tongue, may be passed after the affected glands have been removed and condemned.

Regulation 11, section 12.—A carcass in which lesions of caseous lymphadenitis are present and which is poorly nourished shall be condemned. A carcass showing lesions of caseous lymphadenitis in the superficial lymph glands and visceral organs may be passed for sterilization, provided it is well nourished and the affected organs and parts are removed and condemned. A well-nourished carcass in which lesions of caseous lymphadenitis are limited to the superficial lymph glands or visceral organs with their adjacent lymph glands may be passed without restriction, provided the affected organs and parts are removed and condemned.

Regulation 11, section 16, paragraph 2.—A carcass, in which infestation with Cysticercus bovis is limited to one dead and degenerated cyst, may be passed for food after removal and condemnation of the cyst.

Regulation 11, section 16, paragraph 3.—Carcasses of cattle showing a slight or moderate infestation other than that indicated in paragraph 2, but not as extensive as indicated in paragraph 1 of this section, as determined by a careful examination of the heart, muscles of mastication, tongue, diaphragm and its pillars, and of portions of the carcass rendered visible by the process of dressing, may be passed for food after removal and condemnation of the cysts, with the surrounding tissues, provided the carcasses and parts, appropriately identified by retained tags, are held in cold storage or pickle for not less than 21 days, under conditions which will insure proper preservation; and, provided further, that if the temperature at which such carcasses and parts are held in cold storage does not exceed 15° F., the period of retention may be reduced to 6 days. As an alternative to retention in cold storage or pickle as herein provided, such carcasses and parts may be passed for sterilization.

Regulation 16, section 9.—Inedible grease, inedible tallow, or other inedible fat having the physical characteristics of an edible product shall be denatured or otherwise destroyed for food purposes. Containers of inedible grease, inedible tallow, or other inedible fat shall be conspicuously marked with the name of the product and the word "Inedible." Such containers as tierces and barrels shall have both ends painted white and the word "Inedible" marked thereon in letters not less than 2 inches high, while on tank cars the letters shall be not less than 4 inches high.

Regulation 18, section 9, paragraph 4.—Intestines shall not be used as ingredients of meat food products, excepting under such terms and restrictions as the chief of the bureau may specifically prescribe.

Regulation 25, section 11.—No uninspected meat or product and no inspected and passed meat or product, which is known to have become unsound, unhealthful, unwholesome, or in any way unfit for human food, including any rendered or unrendered inedible grease, inedible tallow, or other inedible fat from the carcasses of cattle, sheep, swine, or goats, and possessing the physical characteristics of an edible product, shall be transported from one State or Territory or the District of Columbia to or through another State or Territory or the District of Columbia, or to any place under the jurisdiction of the United States, or to a foreign country, for industrial use, unless it is first denatured or otherwise destroyed for food purposes. The shipper shall not offer nor the carrier accept for interstate or foreign transportation any such article until it has been denatured or otherwise destroyed for food purposes as required by this section. The carrier shall require and the shipper shall make and deliver to the carrier a certificate in duplicate in the following form:

Date........................, 191 .
Name of carrier ....
Consignor ....
Point of shipment ....
Consignee ....
Destination ....

I hereby certify that the following described inedible meat or product, or inedible grease, inedible tallow, or other inedible fat has been denatured or otherwise rendered unavailable for food purposes and is offered for shipment in interstate or foreign commerce for industrial use exclusively.

Kind of product.	Amount and weight.
....	....
....	....
....	....

....
(Signature of shipper.)
....
(Business or occupation of shipper.)
....
(Address of shipper.)

The signature of the shipper or of his agent shall be written in full. This certificate shall be separate and apart from any waybill, bill of lading, or other form ordinarily used in the transportation of meat. The duplicate certificate shall be forwarded immediately by the initial carrier to the Chief of the Bureau of Animal Industry, Washington, D. C.

As evidence to connecting carriers that the proper shipper's certificate is on file with the initial carrier, the waybills, transfer bills, running slips, or conductor's cards accompanying such shipments shall have embodied therein, stamped thereon, or attached thereto a signed statement in the following form:

(Name of transportation company.)

Unsound, unwholesome, or otherwise unfit for human food, and denatured or otherwise rendered unavailable for food purposes, as evidenced by shipper's certificate on file with initial carrier.

(Signed)........................... *Agent.*

The signature of the agent shall be written in full.

Regulation 27, section 3, paragraph 5.—No inedible grease, inedible tallow, or other rendered inedible fat shall be admitted into the United States for industrial use unless it has been first denatured or otherwise destroyed for food purposes and the containers have been marked in the manner prescribed by regulation 16, section 9.

AMENDMENT 5 TO REGULATIONS 11, 16, 18, 25, AND 27, B. A. I. ORDER 211

Paragraph 4, section 7, regulation 16 of B. A. I. Order 211 (Regulations Governing the Meat Inspection of the United States Department of Agriculture) is hereby revoked.

Regulation 11, section 12. Caseous lymphadenitis. (*a*) A thin carcass showing well-marked lesions in the viscera and the skeletal lymph glands, or such a carcass showing extensive lesions in any part, shall be condemned.

(*b*) A thin carcass showing well-marked lesions in the viscera with only slight lesions elsewhere or showing well-marked lesions in the skeletal lymph glands with only slight lesions elsewhere may be passed for sterilization.

(*c*) A thin carcass showing only slight lesions in the skeletal lymph glands and in the viscera may be passed without restriction.

(*d*) A well-nourished carcass showing well-marked lesions in the viscera and with only slight lesions elsewhere or showing well-marked lesions confined to the skeletal lymph glands with only slight lesions elsewhere may be passed without restriction.

(*e*) A well-nourished carcass showing well-marked lesions in the viscera and the skeletal lymph glands may be passed for sterilization; but where the lesions in a well-nourished carcass are both numerous and extensive it shall be condemned.

(*f*) All affected organs and glands of carcasses passed without restriction or passed for sterilization shall be removed and condemned. The term "thin" as used in this section shall not be held applicable to a carcass which is anemic or emaciated.

Regulation 18, section 1. All meat and products, whether fresh or cured, even though previously inspected and passed, shall be reinspected by bureau employes as often as may be necessary, in order to ascertain whether the same are sound, healthful, wholesome, and fit for human food at the time the same leave official establishments. If upon reinspection any article is found to have become unsound, unhealthful, unwholesome, or in any way unfit for human food, the original mark, stamp, or label thereon shall be removed or defaced and the article condemned: *Provided,* That—

(*a*) If an article becomes soiled or unclean by falling on the floor or in any other accidental way it may be cleaned and presented for reinspection.

(*b*) If an article is found to have absorbed a foreign odor, contains mold or similar substance, or in the case of lard there is present the condition known as tank-water sourness in the first stage, and the article is capable of being rehandled by approved methods for food purposes the official establishment may be permitted, if the necessary steps are immediately taken, to so rehandle it in a manner prescribed by the Chief of the Bureau of Animal Industry.

If upon final reinspection the article is found to be sound, healthful, and wholesome it shall be passed for human food; otherwise it shall be condemned.

Regulation 25, section 10, last paragraph. No meat or product which is unsound, unhealthful, unwholesome, or in any way unfit for human food shall be transported from an official establishment under this section, but it shall be disposed of at the official establishment in accordance with these regulations: *Provided,* That when a product is found to come within one of the classes designated in regulation 18, section 1 (*b*), in respect to which rehandling is permitted it may be transported from an official establishment and admitted into another official establishment for such rehandling. The transportation of such a product from an official establishment shall be in a manner prescribed by the Chief of the Bureau of Animal Industry.

Regulation 27, section 5, paragraph 8. Except as provided in section 11 of this regulation, each consignment of any meat or product of a kind prepared customarily to be eaten without cooking (such as summer sausage, "Italian" and "Westphalia" hams, and the like), which contains any muscle tissue of pork, shall be accompanied, in addition to any other certificate required by this section, by a separate foreign meat-inspection certificate in the following form:

OFFICIAL MEAT INSPECTION CERTIFICATE FOR PORK AND PORK PRODUCTS

(For shipment to the United States of articles of a kind prepared customarily to be eaten without cooking, which contain muscle tissue of pork.)

Place.................................. Date...............191....
(City.) (Country.)

I hereby certify that the article or articles herein described are of a kind prepared customarily to be eaten without cooking, and contain muscle tissue of pork, which, when fresh or freshly cured in salt, was subjected to a temperature not higher than 5° F. for not less than 20 days, or otherwise treated as specified by the Chief of the Bureau of Animal Industry, and that said articles contain no muscle tissue of pork which has not been treated as herein specified.

Kind of product.	Number of pieces or packages.	Weight.
....	....	....
....	....	....
....	....	....

Identification marks on meats and packages ....
Consignor .... Address ....
Consignee .... Destination ....
Shipping marks ....
(Signature) ....
(Name of official of national foreign government authorized to issue inspection certificates for meat and meat food products exported to the United States.)
(Official title) ....

NOTE.—A certificate in the above form is required to accompany each consignment of any meat or product of a kind prepared customarily to be eaten without cooking (such as summer sausage, "Italian" and "Westphalia" hams, and the like), which contains any muscle tissue of pork. This certificate is to be delivered by the consignee or his agent to the inspector of the Department of Agriculture at the point of inspection in the United States.

Each such foreign meat-inspection certificate shall be subject to the provisions of paragraphs 4 to 7, inclusive, of this section.

AMENDMENT 6 TO REGULATIONS 18 AND 25, B. A. I. ORDER 211 (REGULATIONS GOVERNING THE MEAT INSPECTION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE)

Regulation 18, section 3, paragraph 2.—Any meat or product which has been inspected and passed under these regulations and bears the inspection legend may be shipped in interstate or foreign commerce, provided it is sound, healthful, wholesome, and fit for human food and has not been processed, reprocessed, or changed in any manner so as to alter the character of the product.

Regulation 25, section 4, paragraph 3.—Jobbers, wholesalers, and others who operate establishments in which slaughtering or processing is done without the inspection provided for in these regulations and who receive meat or products which have not been processed other than under inspection in compliance with these regulations may ship from such establishment in interstate or foreign commerce under section 5 of this regulation any meat or product which bears the inspection legend and is sound, healthful, wholesome, and fit for human food and has not been processed, reprocessed, or changed in any manner so as to alter the character of the product.

AMENDMENT 7 TO REGULATION 17, B. A. I. ORDER 211 (REGULATIONS GOVERNING THE MEAT INSPECTION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE)

Regulation 17, section 9, paragraph 5.—Lard may have added thereto lard stearin without the presence of added stearin being shown on the label.

AMENDMENT 8 TO B. A. I. ORDER 211 (REGULATIONS GOVERNING THE MEAT INSPECTION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE)

Regulation 28. The carcasses of cattle which are slaughtered on the farm or other place designated by the Chief of the Bureau of Animal Industry and which are examined by bureau inspectors at the time of slaughter, may be marked "Inspected and passed" by the inspectors if, upon inspection, they are found to be sound, healthful, wholesome, and fit for human food.

The provisions of regulation 2 and section 1 of regulation 4 of these regulations are hereby modified to conform with the provisions of this regulation.

AMENDMENT 9 TO THE REGULATIONS GOVERNING THE MEAT INSPECTION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE, FOR THE INSPECTION AND HANDLING OF HORSE MEAT AND MEAT FOOD PRODUCTS THEREOF, AND THE ANIMALS FROM WHICH THEY ARE DERIVED

Provision 1.—Every establishment in which horses are slaughtered for transportation or sale as articles of interstate or foreign commerce, or in which carcasses, parts of carcasses, meat, meat products, or meat food products of, or derived from, horses are, wholly or in part, canned, cured, smoked, salted, packed, rendered, or otherwise prepared for transportation or sale as articles of interstate or foreign commerce which are capable of being used as food for man, shall have inspection under these regulations as amended.

Provision 2.—The slaughter of horses and the preparation and handling of the meat and meat food products thereof shall be conducted in establishments separate and apart from any establishment in which cattle, sheep, swine, or goats are slaughtered, or the meat or meat food products thereof are prepared or handled.

Provision 3.—All horses found upon either ante-mortem or post-mortem inspection or examination to be affected with strangles, purpura hemorrhagica, azoturia, forage poisoning or so-called cerebro-spinal meningitis, dourine, acute influenza, generalized osteoporosis, glanders, farcy, or other malignant disorder, acute inflammatory lameness, or extensive fistula shall be condemned.

Provision 4.—All horse carcasses, parts of carcasses, meat and meat food products thereof shall be conspicuously labeled, marked, branded, or tagged "Horse meat" or "Horse-meat Product."

Provision 5.—The domestic meat labels for horse meat or meat food product thereof shall be printed on paper, light green in color. The legend composing the body of each label shall be as follows: "The horse meat or meat food product thereof contained herein has been U. S. inspected and passed by the Department of Agriculture," and in lieu of the phrase "domestic meat label" there shall be printed thereon the phrase "domestic horse-meat or horse-meat product."

Provision 6.—Numbered stamps and certificates printed on paper light green in color, to be known as export horse-meat stamps and certificates, shall be issued to identify all horse-meat and meat food products thereof packed for export. Such stamp or stamps and certificate shall be issued for each consignment of horse meat or meat food product thereof forwarded from the United States.

Provision 7.—All the other provisions of the regulations governing the meat inspection of the United States Department of Agriculture designated as B. A. I. Order 211, as amended, unless specifically inapplicable, are hereby made applicable to the inspection and handling of horse meat and meat food products thereof and the animals from which they are derived.

LAW UNDER WHICH THE FOREGOING AMENDMENT IS ISSUED

Extract from an act of Congress entitled "An act making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1920," approved July 24, 1919 (Public, No. 22):

For additional expenses in carrying out the provisions of the meat-inspection act of June 30, 1906 (Thirty-fourth Statutes at Large, p. 674) as amended by the act of March 4, 1907 (Thirty-fourth Statutes at Large, p. 1256), there is hereby appropriated for the fiscal year ending June 30, 1920, $903,960, of which sum $100,000 may be used for the inspection of equine meat in the manner provided in said act, as amended. And, hereafter, no person, firm, or corporation, or officer, agent, or employe thereof, shall transport or offer for transportation, and no carrier of interstate or foreign commerce shall transport or receive for transportation from one State or Territory or the District of Columbia to any other State or Territory, or the District of Columbia or to any place under the jurisdiction of the United States or to any foreign country any of such meat or food products thereof unless plainly and conspicuously labeled, marked, branded, or tagged "Horse-meat" or "Horse-meat Product" as the case may be, under such rules and regulations as may be prescribed by the Secretary of Agriculture. All the penalties, terms, and provisions in said act, as amended, except the exemption therein applying to animals slaughtered by any farmer on a farm, to retail butchers and retail dealers in meat food products supplying their customers, are hereby made applicable to horses, their carcasses, parts of carcasses, and meat food products thereof, and the establishments and other places where such animals are slaughtered or the meat or meat food products thereof are prepared or packed for the interstate or foreign commerce, and to all persons, firms, corporations, and officers, agents and employes thereof who slaughter such animals or prepare or handle such meat or meat food products for interstate or foreign commerce.

AMENDMENT 10 TO REGULATION 24, B. A. I. ORDER 211 (REGULATIONS GOVERNING THE MEAT INSPECTION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE)

Regulation 24, section 3, paragraph 1.—No person operating any steam or sailing vessel shall receive for transportation or transport from the United States to Great Britain or Ireland, or any of the countries of continental Europe, or to Argentina, Peru, Mexico, or the French Antilles, any meat or product, except ship stores and small quantities exclusively for the personal use of the consignee and not for sale or distribution, unless and until a certificate of inspection or exemption from inspection covering the same has been issued and delivered as provided in this regulation. The requirement of export certificates is waived for meat and products exported to countries other than those named in this paragraph and to all countries in cases of meat and products covered by exemption export certificates issued pursuant to paragraph 2 of this section.

AMENDMENT 11 TO REGULATION 16, B. A. I. ORDER 211 (REGULATIONS GOVERNING THE MEAT INSPECTION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE)

Regulation 16, section 11.—All meat and meat food products intended for the United States Navy and found upon inspection by bureau inspectors to conform to the Navy specifications shall bear a special mark composed of the letters U. S. N. inclosed within a heart-shaped shield the top of which is formed of two depressed curved lines meeting at the center.

AMENDMENT 12 TO REGULATION 17, B. A. I. ORDER 211 (REGULATIONS GOVERNING THE MEAT INSPECTION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE)

Regulation 17, section 9, paragraph 7.—Labels for mixtures, other than oleomargarin, consisting of fat derived from carcasses of cattle, sheep, swine, or goats, shall bear the names of the ingredients in a prominent manner in the order of their percentages, preceded by the statement "composed of" or "made from," or an equivalent statement. If vegetable fat is included in such mixture, the phrase "vegetable fat" (or vegetable oil, or vegetable stearin, or both, as the case may be) or the specific name or names of the vegetable fat shall appear among the names of the other ingredients. Tierces and barrels containing "compound," or "lard substitute," or "lard compound," shall, immediately after filling, be legibly marked on one end, and on the side near the end, with the true name of the product. Tin pails, drums, tubs, and similar containers of such products shall bear the true name of the product also on the side at the time of filling. Mixtures of which the lard ingredient equals or exceeds in amount the other ingredients combined may bear the name "lard compound" preceding the statement of composition provided for in this paragraph.

AMENDMENT 13 TO REGULATION 24, B. A. I. ORDER 211 (REGULATIONS GOVERNING THE MEAT INSPECTION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE)

Regulation 24, section 1, paragraph 1.—A numbered meat-inspection stamp shall be affixed to each outside container (except cloth wrappings) of any inspected and passed meat or product for export, except ship stores and small quantities exclusively for the personal use of the consignee and not for sale or distribution.

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